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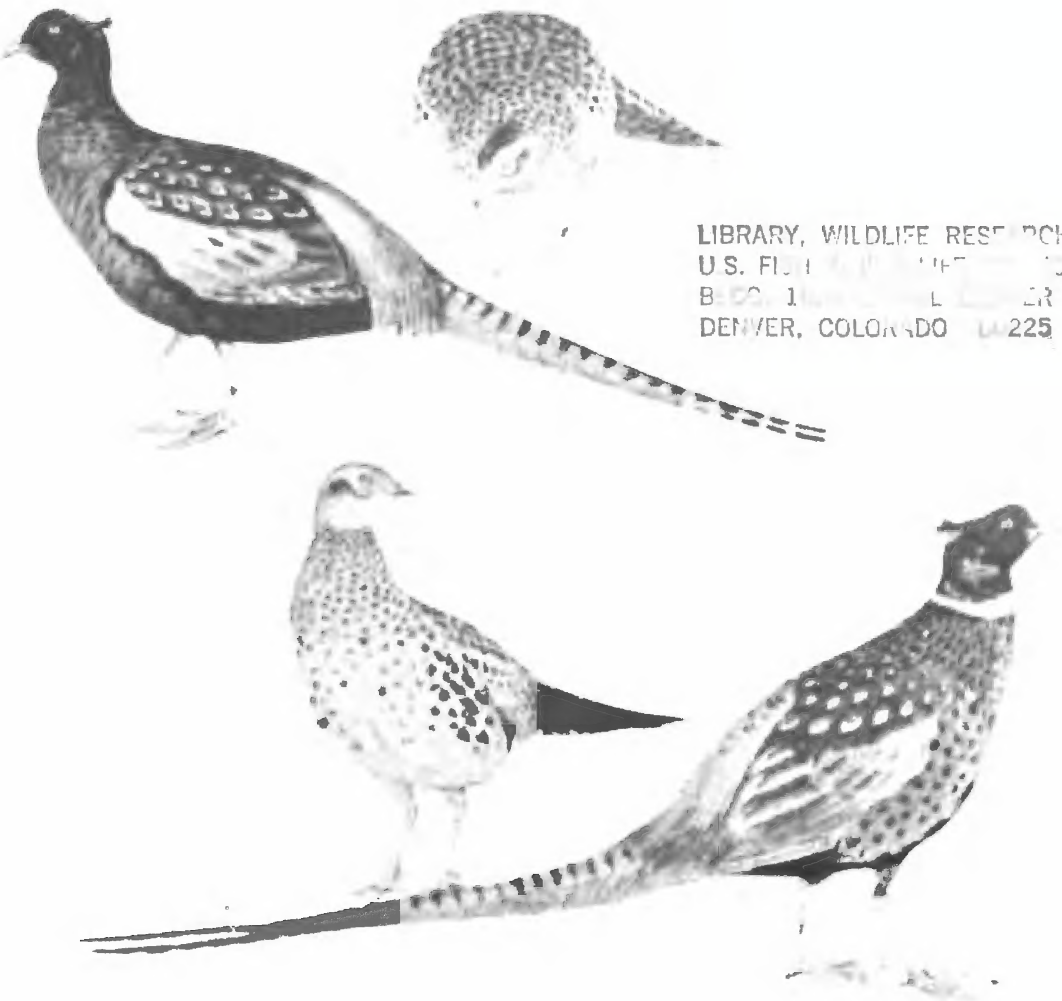
A Study and Review of the JAPANESE GREEN and the KOREAN RING-NECKED PHEASANTS



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Special Scientific Report--Wildlife No. 83

UNITED STATES DEPARTMENT OF THE INTERIOR

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On the cover

Male and female of Japanese green and Korean ring-necked pheasants. (Courtesy of The Great Japan Hunting Society)

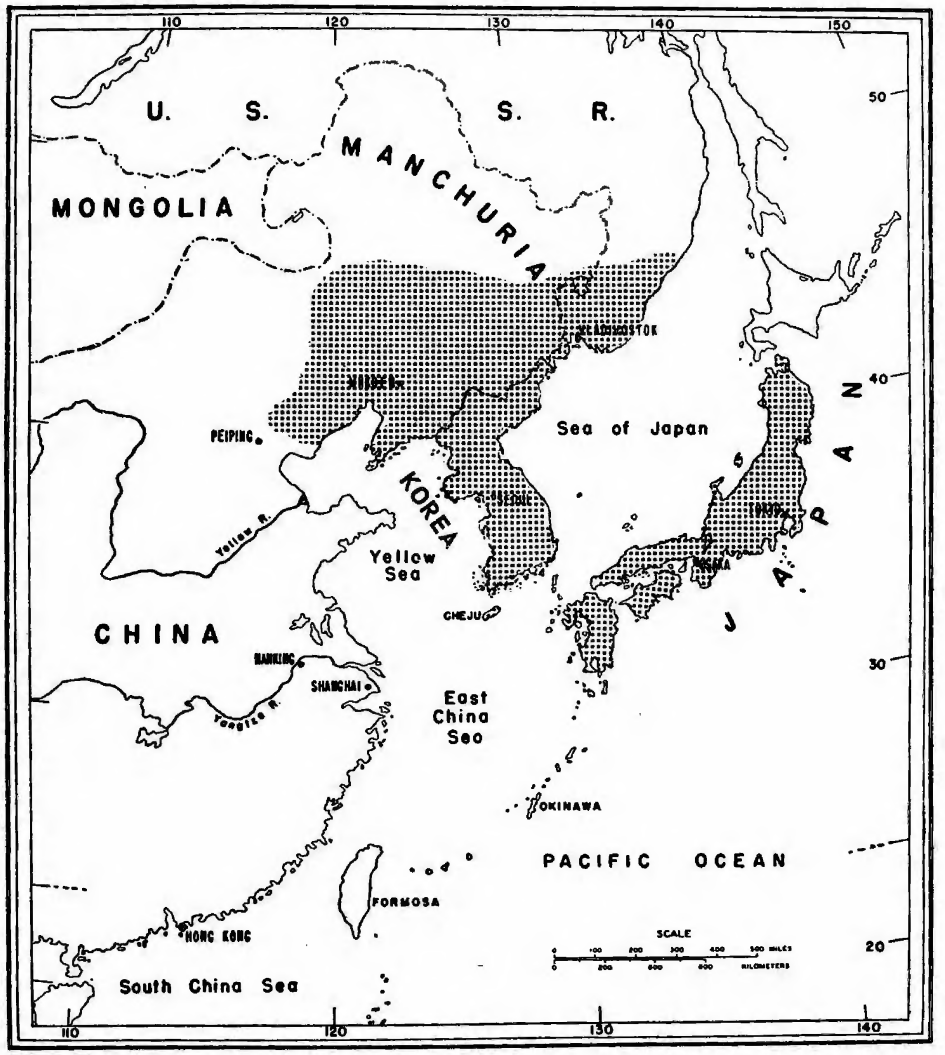
On the title page

Map of the Far East; range of Japanese green and the Korean and Manchurian ring-necked pheasants.

A Study and Review of
THE JAPANESE GREEN AND THE KOREAN RING-NECKED PHEASANTS

By

Wayne H. Bohl
Division of Wildlife Research
Bureau of Sport Fisheries and Wildlife



Special Scientific Report--Wildlife No. 83

Washington, D.C. · June 1964

THE FOREIGN GAME INTRODUCTION PROGRAM

Year by year the number of individuals seeking relaxation through hunting is increasing. Yet the area available for this sport is slowly decreasing. Likewise, much of the habitat which mothers the game crop is becoming less and less able to produce shootable surpluses under the impact of clean farming, over-grazing, drainage, power equipment, increased use of insecticides and herbicides, scientific forestry, urbanization, and declining soil fertility.

Faced with this situation, common sense dictates an all-out effort to increase habitat productivity. But there are many habitats which have been so thoroughly changed by man that native game species can no longer maintain themselves therein in numbers sufficient to provide good hunting. Competing interests and the cost of reversing this trend are such that only a part of these lands can be restored to reasonable productivity in the foreseeable future. There are other coverts which never were fully occupied by native game birds or mammals possessing the characteristics requisite to survival in the face of today's intensive hunting pressure. For these, new, adaptable species possessing a high hunting resistance should be sought, so that such areas might provide greater hunting opportunities. This is the logic behind the foreign game introduction program as developed cooperatively by the U. S. Fish and Wildlife Service, cooperating State Fish and Game Commissions, and the Wildlife Management Institute.

The program is based on requests for assistance from State Fish and Game Commissions following an ecological appraisal of their game-deficient habitats. After such information is in hand, biologists are assigned to make a careful study of game species occupying similar habitats and climates in foreign countries. From dozens considered, one or two may be selected on the basis of their characteristics, habits, reproductive capacity, resistance to predation and disease, relationship to agriculture, ability to withstand heavy hunting pressure, and the possibility of competition with game species native to the United States. Modest, carefully planned trial introductions of these species, utilizing wild-trapped or farm-reared individuals, carefully quarantined before shipment, are then carried out in cooperation with interested State Fish and Game Commissions. Unplanned or "hit and miss" introductions are actively discouraged.

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FOREWORD

Even before the inception of the Foreign Game Introduction Program in 1949, State game departments and wildlife officials were interested in the possibility of obtaining new pheasant species for introduction into United States habitats. Success of the ring-necked pheasant strains in the United States is now past history. What are presently desired are new pheasants that can be utilized in areas where only marginal success has occurred with the ring-necked pheasant or in habitats where this and other species have never been successful. This latter area includes the southwestern United States from southern California eastward into Texas and those States further east and south of current ringneck range. Habitats vary from semi-arid desert lands with interspersed agricultural fields to humid woodland and agricultural lands.

States cooperating with the Foreign Game Introduction Program are experimenting with several strains of pheasants in hopes of extending pheasant ranges. Included are the white-crested kalij pheasant (Lophura leucomelana) and the Reeves pheasant (Syrmaticus reevesi) from mountainous woodland habitats. From the true pheasant group, the western and eastern Iranian blackneck (Phasianus colchicus talischensis and P. c. persicus), are typical of agricultural areas, and the Afghan white-winged pheasant (P. c. bianchii) is common to semi-arid desert areas and agricultural lands. Among those found in the Far East are the Japanese green pheasant (Phasianus versicolor robustipes) of mountainous, woodland, and agricultural habitats, and the Korean ring-necked pheasant (Phasianus colchicus karpowi) from similar habitats. This report concerns the last two pheasant species mentioned above.

The Japanese green and Korean ring-necked pheasants are prized hunting birds in Japan and Korea respectively. Both pheasant species live in close association with hilly terrain where woodland and agricultural habitats occur. Climatic conditions, both summer and winter, are somewhat similar to parts of the eastern and the central United States differing mainly in the distribution of rain and snow during the year. In the species winter ranges temperatures extend from mild to near-zero, with varying amounts of snow. Annual rainfall varies from 40 to 80 inches or higher.

This report expands information originally presented in the Game Bird Data Sheets covering these two species. Emphasis has been placed upon those characteristics of life history most important in the consideration of either species for trial introduction into the United States. A comprehensive review of existing literature followed by limited field studies in Japan and South Korea in 1958-59 provide the data for this report.

Appreciation is extended M. Y. Nuttonson of the American Institute of Crop Ecology who granted permission to use certain data from an Institute report. In addition, certain pheasant life history information and photographs were kindly furnished through the courtesy of Forestry and Wildlife officials in Japan and South Korea. Special thanks for assistance are extended to Mr. Toyo Matsuo and Mr. Seichii Kuzu, Forestry Agency, Tokyo; Mr. Keisuke Kobayashi, Kobe, Japan; and Mr. Chester M. Fennell, Seoul, South Korea.

ABSTRACT

Following a general review of the taxonomy, distribution and descriptions of the Japanese green pheasants (Phasianus versicolor) and the Korean and Manchurian ring-necked pheasants (P. c. karpowi and P. c. pallasi) detailed consideration is given to their habitat and cover preferences, climatic and food and water requirements, general habits and reproductive capacity. Their relation to agriculture, to other game birds within their native range, an evaluation of their potentialities for trial introduction into the United States and suggestions for game farm propagation are also discussed.

JAPANESE GREEN PHEASANTS

Japanese green pheasants are common residents throughout Japan except on the northern island of Hokkaido. Their main range extends from cold areas with high snowfall in northern Honshu, the large central island, to the southernmost island of Kyushu with its semi-tropical low mountainous woodlands and scattered agriculture.

Green pheasants are of the pheasant family in the true pheasant group, all of which are found in the genus Phasianus. In addition to three subspecies of green pheasants classified by Delacour (8), the genus includes four black-necked, six white-winged, three Kirghiz, one olive-rumped and seventeen grey-rumped pheasants. Many of these are ringnecks. Except for the green pheasant and the Formosan pheasant, true pheasants inhabit mainland areas with but minor exceptions. Most of the major populations of the true pheasant group in the world today are associated with some form of agriculture, particularly grain producing areas.

In looking for a pheasant that might inhabit range not occupied by ring-necked pheasants in the United States, the various subspecies of green pheasants have been evaluated since 1958 by the Foreign Game Introduction Program. One or more of these subspecies might be acceptable as a new game bird in portions of eastern, southeastern or northwestern United States where either wooded flatlands or hilly country are intermixed with agricultural fields.

Climatic counterparts of the green pheasant's range should be found in the higher rainfall areas of the United States. Certain subspecies are able to endure some snow while others seldom, if ever, experience it. In the native range of the northern green pheasant, winters are cold and summers are mild while where the southern green pheasant is found, winters are mild and summers warm. Relatively high humidity throughout the year is common for most of Japan. The green pheasant's ability to exist and thrive under Japanese climatic conditions makes it worthy of detailed consideration for trial introduction into certain areas of the United States even though some differences are found in monthly, seasonal and annual totals of precipitation in Japan when compared to areas in the United States which appear to be otherwise similar.

In general, the northern green pheasant (P. v. robustipes), under conditions of considerable rainfall, snowfall and fairly cold winters, would appear climatically adapted to the coastal mid-Atlantic States south to North Carolina and west into Tennessee and Kentucky. There also might be some possibilities for trial introductions of this subspecies into the western parts of our Pacific States. The southern green pheasant (P. v. versicolor) of southwestern Honshu and Kyushu might find its most comparable climatic conditions in southeastern United States as far south as Louisiana, Mississippi, and South Carolina.

Taxonomy and Distribution

Order	Galliformes
Family	Phasianidae
Genus	*Phasianus*
Species	*P. versicolor*

Subspecies

P. v. robustipes	Northern green pheasant	Most of Honshu, intergrading with *versicolor* in the southwest, and with *tanensis* north of Izu and Miura peninsulas; Shikoku.
P. v. tanensis	Pacific green pheasant	Honshu, in warmer, more humid parts of the Izu and Miura peninsulas, the Seven Islands of Izu, Tanegashima and Yakushima (south of Kyushu).
P. v. versicolor	Southern green pheasant	Kyushu and southwestern tip of Honshu in Yamaguchi prefecture.

This report follows the classification of Delacour (8). Distribution is indicated in Figure 1. It has been noted by Delacour and others that all forms of true pheasants replace one another geographically and interbreed freely where their ranges overlap, producing completely fertile hybrids. Due to striking color differences between western mainland true pheasants and the green pheasants of Japan, Delacour has suggested the formation of two separate species, *P. colchicus* (of the mainland) and *P. versicolor* resident in Japan.

While Delacour lists three races of green pheasants (*P. versicolor* ssp.) in Japan, Peters (16) divides the Japanese green pheasants into four subspecies, *P. colchicus robustipes*, *P. c. versicolor*, *P. c. tanensis*, and *P. c. kiusuensis* (Figure 2). In "A Hand-List of the Japanese Birds," 1958, the Ornithological Society of Japan also lists four subspecies of the green pheasant but differs as follows: *P. c. robustipes*, *P. c. tohkaidi*, *P. c. tanensis*, and *P. c. versicolor*. Austin and Kuroda (4) follow the taxonomy of Delacour.

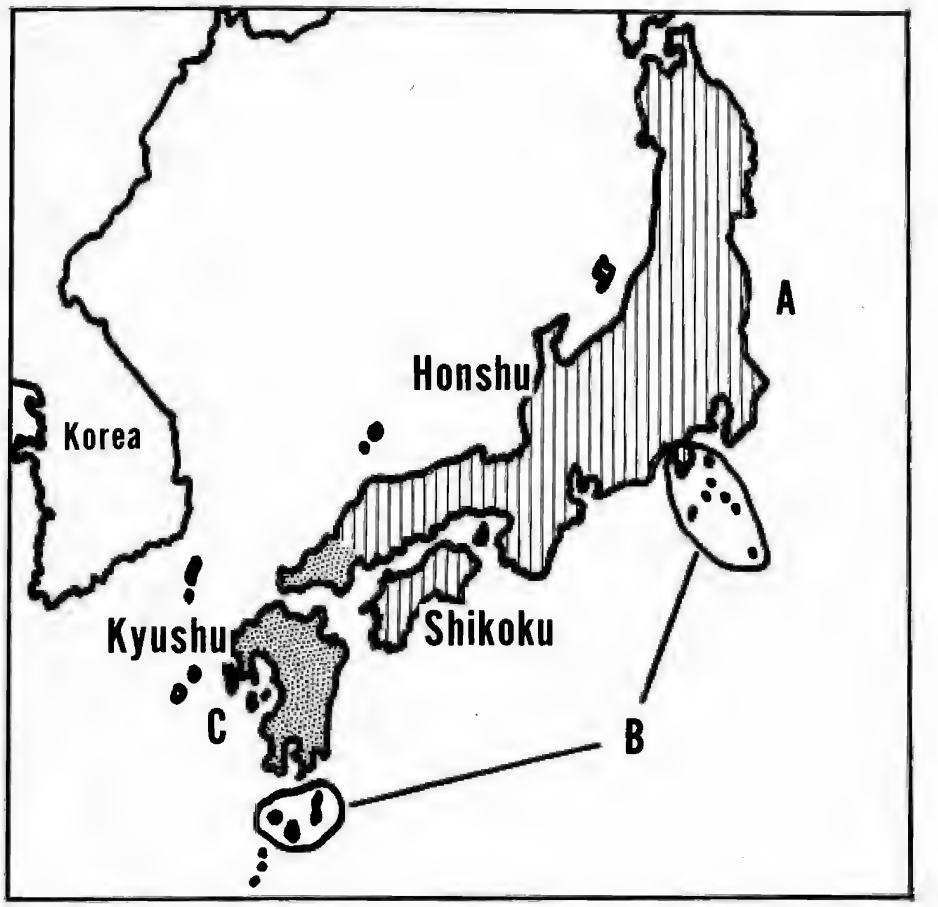


Figure 1. The distribution of three subspecies of green pheasants in Japan as modified after Delacour (8).
A. Phasianus versicolor robustipes
B. P. v. tanensis
C. P. v. versicolor

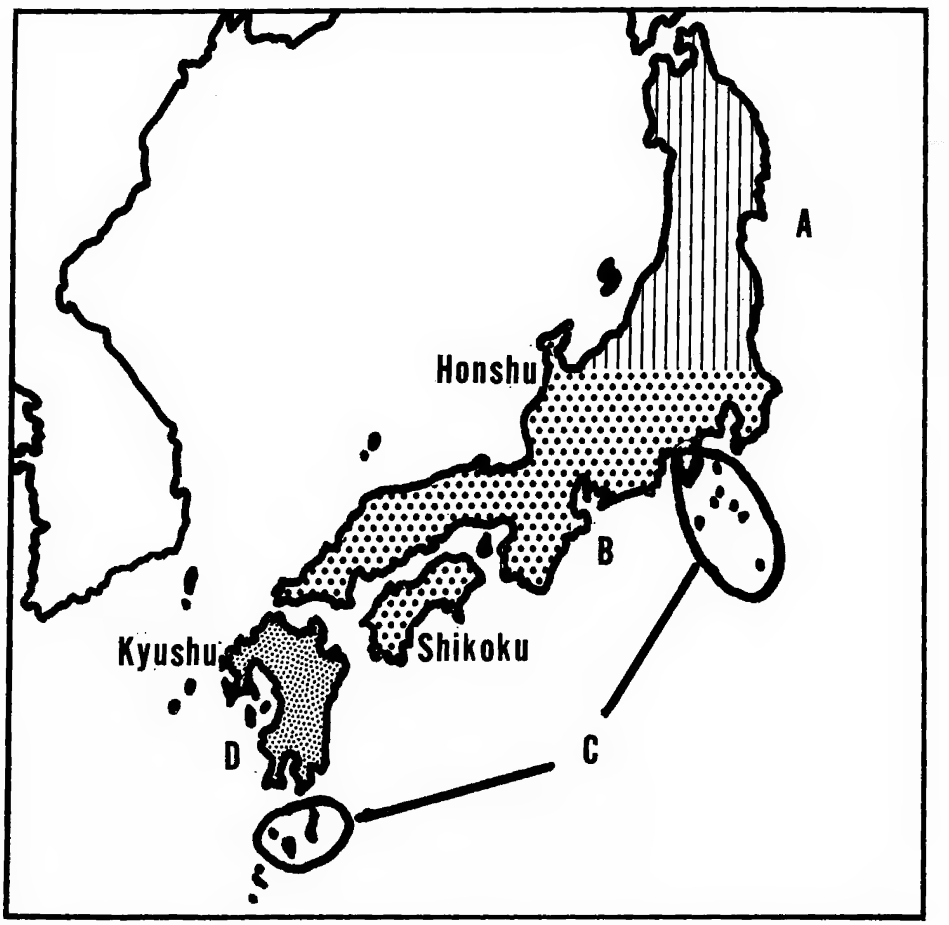


Figure 2. The distribution of four subspecies of green pheasants in Japan as modified after Peters (16).

A. Phasianus colchicus robustipes
B. P. c. versicolor
C. P. c. tanensis
D. P. c. kiusiuensis

Introductions

Green pheasants have some very desirable hunting qualities and quite naturally sportsmen throughout the world have attempted to introduce these birds into their own countries during the past 100 years. They have been raised in captivity almost as successfully as the ring-necked pheasant. According to Delacour (8) green pheasants were established by 1860 in Europe and in the 1880's in Oregon. The southern green pheasant (P. v. versicolor) was introduced into Hawaii prior to 1900 as noted by Schwartz (17) and is still fairly successful on the windward slopes of Mauna Kea and Mauna Loa on Hawaii Island.

With today's comparative stabilization of the ringneck pheasant range in the United States it has been hoped that trial experiments with races of the green pheasant would result in their establishment where ring-necked pheasants either have not done well or have never been established. (See Figure 3.) In cooperation with the Foreign Game Introduction Program, Virginia, Tennessee, Alabama, Kentucky, Ohio and Illinois have been raising the northern green pheasant (P. v. robustipes) on State game farms. During the same period Virginia, Tennessee, Alabama and Ohio released from game farm stock 2,200 of these pheasants. Encouraging results on carry-over and reproduction in the wild have been noted by State game personnel on several release areas in eastern Virginia (7). This particular subspecies has been the one most commonly liberated in several parts of the world during the past 100 years. P. v. versicolor has been liberated in fewer numbers during the same period.

Status in Japan

This report emphasizes the northern green pheasant (P. v. robustipes) but also discusses the southern green pheasant (P. v. versicolor).

It was learned while working in Japan during 1958-59 that the southern green pheasant has been so reduced in wild population numbers that northern green pheasants (P. v. robustipes) are now being propagated on the Kyushu game farm at Kagoshima for release in nearby habitats. Once this has been completed it may be difficult to obtain pure strain of P. v. versicolor. With this situation in mind, and recognizing the interest among the States in acquiring green pheasants suitable for colder parts of the United States, the Foreign Game Introduction Program concentrated its study and procurement on the northern green pheasant of Honshu.

Common Names

Some common names applied in Japan to the green pheasants are as follows:

Kiji	General term for green pheasant
Kita-kiji	Northern green pheasant
Kiushiu-kiji	Southern green pheasant
	Kyushu green pheasant
	Kiushiu green pheasant
Shima-kiji	Pacific green pheasant

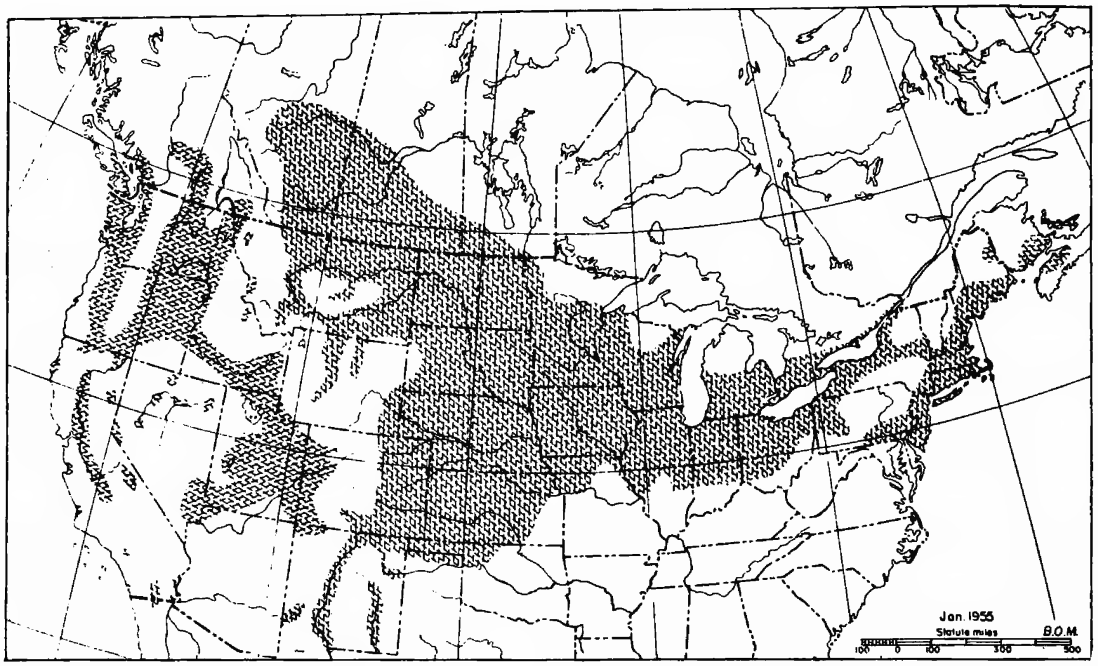


Figure 3. Past and present distribution of the ring-necked pheasant in the United States. (Map from Fish and Wildlife Service, Circular 34, 1955)

Distribution and Relative Abundance

The range of the three subspecies of green pheasants in Japan extends between latitude 30° and 41° N. This is approximately the same latitude as that between Trenton, New Jersey and Jacksonville, Florida. Green pheasants are not native to the northern Japanese island of Hokkaido but they have recently been imported there for propagation. Excluding certain heavy snowfall areas of western Honshu, the green pheasant is found on the plains, in the valleys and in the low foothills in elevations up to 3,500 feet. Below this elevation the birds usually will be found in close proximity to any land which can be cultivated.

Green pheasants are sought widely by the Japanese hunter but, where protected properly throughout the year, their numbers are normally adequate to provide several birds a day for the ardent sportsman. However, due to increased hunting pressure since World War II, pheasant populations have declined in Kyushu and Honshu. In its effort to offset these decreases in population, the Wildlife Section of Japan has increased artificial propagation and created additional wildlife reserves and sanctuaries. Further increases in human population may well hinder the maintenance of adequate numbers of green pheasants in Japan.

Although time for field study in Japan was limited, Foreign Game Introduction Program personnel inspected the green pheasant's habitat in northern and central Honshu, Oshima Island and south into the Kagoshima area of Kyushu. This land area approximates in size half the State of California. In the area studied, Japanese hunters today harvest annually over 450,000 green pheasants.

Fewer green pheasants were seen on Kyushu than were noted on Honshu and Oshima Islands. They are still common in the more wild or remote areas of Japan as well as around Tokyo. On the brush-covered peninsulas opposite the base occupied by the U. S. Navy at Yokosuka the green pheasant and Chinese bamboo partridge both are present and are a challenge to bag in their escape cover. A good hunting dog is desirable in order to flush the wild green pheasant from its brushy-wooded coverts.

Description

The plumage of the male green pheasant is dominantly metallic; underparts are either entirely green, as in northern Honshu, or more purplish and bluish below for the southernmost bird, according to Delacour (8), and Austin and Kuroda (4). A white collar, like that of the ring-necked pheasant from Formosa, Korea and China does not occur on male green pheasants. Austin and Kuroda note that females of the green pheasant subspecies cannot be distinguished from one another with any certainty.

The green pheasants show a great deal of individual variation with no clear-cut morphological differences between subspecies, according to Austin and Kuroda. They also report that while there is little geographic size variation, a regional color variation has been observed ranging from lighter in the colder northern part of the range to darker feather coloration where high rainfall is coupled with subtropical vegetation in southern Kyushu habitat. The following simplified key illustrates this color variation from northern Honshu to the southern island of Kyushu.

P. v. robustipes	Northern green pheasant	gray-crowned
P. v. versicolor	Southern green pheasant	green-crowned
P. v. tanensis	Pacific green pheasant	green-crowned but characterized by being more purplish and bluish below with the back and rump grayer and bluer than are northern and western birds

Following are descriptions of the male and female northern and southern green pheasants as described by Delacour (8).

Male

P. v. robustipes - "Differs from versicolor in its lighter colour; crown greyish bronzy green with often ill-defined grey or white eyebrows; mantle more bronzy; back and rump bluish grey with an olive tinge on the lower part and middle; under parts slightly greener, less bluish. Smaller: wing: 215-225 mm."

P. v. versicolor - "Crown dark green; general colour dark, the lower back and rump mostly green; under parts bluish green. Rather large: wing: 225-243 mm."

Female

P. v. robustipes - "Lighter, with less green reflections on the mantle."

P. v. versicolor - "Dark,with a great deal of metallic green on the mantle. Wing: 200-213 mm."

According to Delacour's general comment about P. versicolor: "The female is more strongly mottled than that of colchicus; the dark part of the feathers of the mantle is black and extends right up to the narrow, pale brown border, and it has a green sheen near the tip; the under parts are more vermiculated and blotched than in any other form of True Pheasants."

Size and Weight

Generally, birds of the green pheasant group are slightly smaller in body size than are ring-necked pheasants, Available records show the male green pheasants as averaging 2 lbs. to 2 lbs. 8 oz., while females range from 1 lb. 12 oz. to 2 lbs. By comparison, our wild ring-necked pheasants in the United States range from 2 lbs. 12 oz. to 3 lbs. for male birds with females averaging 2 lbs. to 2 lbs. 12 oz. in weight.

Habitat and Cover Preferences

Northern green pheasants occupy the greater portion of Honshu and also inhabit Sado and Shikoku islands. Their altitudinal ranges extend from the seashores into the higher plateaus and mountains up to approximately 3,500 feet elevation. Green pheasants are nonmigratory.

On all of the islands of Japan, except Hokkaido, the green pheasant may be found living in sparse woods or brushland adjacent to cultivated upland fields. It also inhabits grassy areas near or adjacent to rivers and cultivated land, in low hilly land along the coast, and on island mountains where brush and tree species provide cover and food.

Cover preferences for night roosting include hillsides or grass lands near hill ridges. Early in the morning the pheasant moves downward from its roost to the base of the hill or terraced land where there are crops, grass, or brush. The green pheasant seeks its feeding, resting and dusting areas on hillsides, in grass lands, or in cultivated fields. Cultivated croplands frequented most often are rice, soybeans, barley, wheat, other grains and vegetable crops.

More than one-half of the total land area of Japan is covered with a wide variety of broad-leaved and coniferous forest tree species which often have dense undergrowths. In the range of the northern green pheasant, in the northern half of Honshu below 3,500-foot elevations, the forest vegetation includes conifers and deciduous broad-leaved tree species as well as evergreens. Conifers include three species of pines (Pinus) and other tree species such as Larix, Thujopsis dolabrata, Abies firma, Thuja standishii, Taxus cuspidata and the Japanese redwood (Cryptomeria japonica). Below elevations of 1,600 feet, deciduous tree and understory vegetation are represented by acacia (Albizzia julibrissin), Celtis japonica and Salix integra. At slightly lower elevations grow Quercus, Fagus, Acer, Ulmus, Magnolia, Prunus, Aesculus and Japanese chestnut (Castanea crenata) and other species.

Broad-leaved evergreens grow mainly below 1,600 feet and include the more common tree and brush species such as Cyclobalanopsis spp., Eurya japonica, Smilax china, along with the wild camellia (Camellia japonica). Several species of tall bamboo (Phyllostachys) often occur around agricultural fields and village houses.

The dwarf bamboo such as Arundinaria communis, Pleioblastus chino and Sasa albo-marginata grow as rank understory vegetation sometimes forming impenetrable thickets. Bamboo plants abound in northern green pheasant range, particularly in moist canyons and on hillsides down to the edges of cultivated fields. Characteristic understory plant species found intermixed with bamboo, particularly in the vicinity of northernmost stream banks or marshes, include Menyanthes trifoliata, Phalaris arundinacea, Phragmites communis, Typha latifolia and Zizania latifolia. In shady and moist areas are found such plant genera as Hosta, Lysimachia and Patrinia.

Other understory vegetation widespread in the range of the northern green pheasant includes Carex lanceolata, Carex nervata and Japanese goldenrod (Solidago japonica). Growing on fertile and humid inland plains is Petasites amplus. Thick stands on steep mountain slopes are formed by white clover (Trifolium repens). Some other common legumes growing wild are Lespedeza bicolor and Pueraria thunbergiana.

In dry, sandy areas the common ground cover may consist of Ophiopogon japonicus, and the chief dry land grass would be Miscanthus sinensis. Vegetation growing abundantly in dry fields and along disturbed road beds includes such genera as Lotus, Potentilla, Pteridium, Inula, Ixeris, Pulsatilla and Zoysia.

Figure 4. Northern green pheasant habitat in northern Honshu, Iwate Prefecture. Both northern green and copper pheasants were present when there was about one foot of snow on the ground.

Figure 5. In interior central Honshu, Saitama Prefecture, green pheasants prefer the association of brushy, sparse forest areas adjacent to dry farming land.

Figure 6. Excellent green pheasant habitat in Nara Prefecture of southern Honshu. (Photos by Wildlife Section, Ministry of Agriculture and Forestry, Japan).

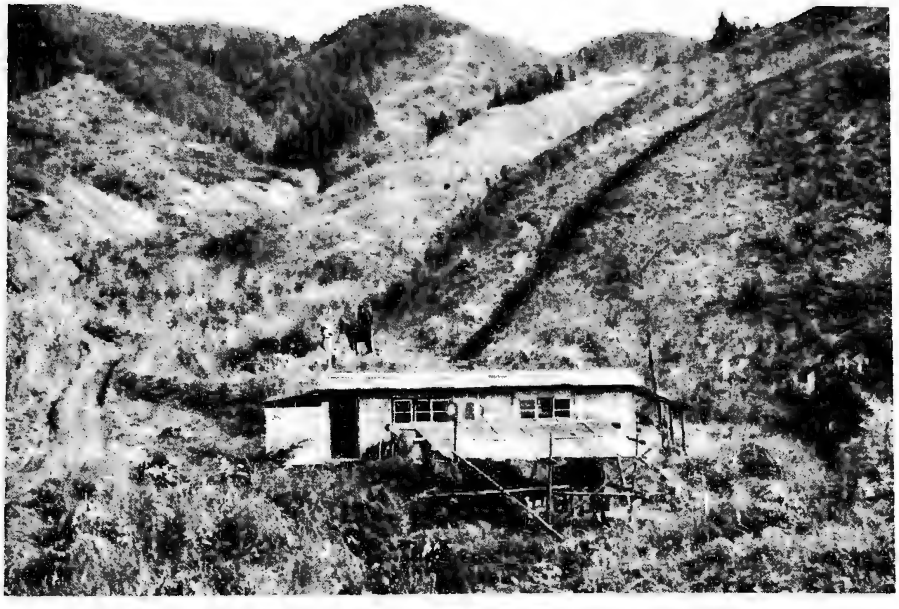


Figure 7. A brushy hillside remains after woodcutters have taken the trees. This type cover adjacent to agricultural fields is much preferred by the green pheasant in Shizuoka Prefecture, Honshu. (Photo by Wildlife Section, Ministry of Agriculture and Forestry, Japan)

Figure 8. Grain crops on terraced hillsides with nearby brushy cover provide excellent habitat in southwestern Honshu. (Photo by Wildlife Section, Ministry of Agriculture and Forestry, Japan)

Figure 9. Excellent Kyushu green pheasant habitat on the southernmost tip of Kyushu.

Figure 10. This area in southern Kyushu has an average annual precipitation of over 80 inches and provides good habitat conditions for the Kyushu green pheasant.

Figure 11. Agricultural and low mountainous area south of Kagoshima, Kyushu. Pine trees and bamboo plants are plentiful on the hillsides.

Figure 12. Uncultivated areas on Kyushu adjoining the sea are also frequented by the Kyushu green pheasant as well as by the Chinese bamboo partridge.

The cold climate vegetation of Sado Island, off the northwest coast of Honshu includes the grass, Elymus mollis, and forbs such as Iris, Litium, Rhododendron, Samolus and Rosa.

In central Honshu plant species are similar to those noted for northern Honshu coverts. Conifers include the Japanese redwood tree (Cryptomeria japonica), false arborvitae (Thujopsis dolobrata) and Japanese cypress (Chamaecyparis obtusa). The Japanese redwood trees and false arborvitae prefer humid climate and fertile soil.

Meadow species in central Honshu include a wide distribution of dwarf bamboos such as Sasa, Sasamorpha, Pleioblastus chino and Arundinaria. Forage grasses with representatives in the United States are Echinochloa, Phalaris, Agropyrum, Avena, Bromus japonicus, Cynodon, Digitaria, Poa and Setaria spp. Wild legumes present include three species of Lespedeza, and representatives of the genera Trifolium, Pueraria and Kummerowia.

The topography of Japan is predominantly mountainous and hilly with associated valleys and a few intensively cultivated plains. Only one-sixth of the land area in Japan is under cultivation; this approximates 24,500 square miles, the equivalent of the combined cultivated and harvested acreage of the States of Virginia, North Carolina and South Carolina.

Because of the volcanic origin of the archipelago of Japan, many of its soil types have developed from volcanic ash. The underlying rock in part of Japan is composed mainly of granite and traprock; other parts are underlain with shale, sandstone and limestone. It is reported that many of the brown forest soils were developed from leaching. Immature soils extend over vast mountainous areas. Numerous mountain streams, deriving their water from Japan's high rainfall, deposit large amounts of sand, gravel, clay cobbles and similar unconsolidated material in the lower valleys and plains. The natural fertility of most Japanese soils is rather low, and soil erosion and leaching are conducive to the development of largely acid soils according to Nuttonson (13) and the Japanese Ministry of Agriculture and Forestry (12).

Habitat conditions including vegetation and soils on Shikoku in the range of the northern green pheasant are similar to those found further west and north on Honshu. The climate is warmer, however, and snow rarely occurs at this more southern latitude.

The southern green pheasant on Kyushu is found in habitat similar to that in the range of the northern green pheasant. Milder winters and warmer summers here, coupled with high humidity conditions, result in luxuriant vegetation coverts for the pheasants, particularly at the lower elevations. Snow is rare in the range of the southern green pheasant and no winter altitudinal movement has been reported.

More evergreen and deciduous broad-leaved trees than conifers grow on Kyushu, indicating the influence on vegetation of a warm climate with high rainfall. Growing only on southern Kyushu and southward are the banyan tree (Ficus superba) and two genera of palm trees, Cycas and Livistona. Also found mainly in the southern ranges is greenbrier (Smilax nipponica). Four species of evergreen oaks (Cyclobalanopsis) and Quercus phylliraeoides, Lithocarpus edulus, Machiles thunbergii and Distylium racemosum are found below 2,800 feet in the range of the southern green pheasant. Deciduous broad-leaved trees and bamboo species are similar to those found in more northern green pheasant ranges. Understory vegetation favored by the warm climate includes both tall and dwarf bamboos.

Chinese silvergrass (Miscanthus sinensis) covers many small clearings between cultivated croplands and forests. The following plants frequently grow wild along roadsides and in cultivated fields: Lespedeza bicolor, Lespedeza cumeata, Medicago lupulina, Trifolium repens, Pueraria thunbergiana and grass of the genera Agrostis, Cynodon, Imperata, Poa and Zoysia. Western bracken (Pteridium aquilinum) is also represented. Vegetation appearing mainly in northern Kyushu includes genera of Carex, Cymbopogon, Erigeron, Ixeris and Solidago.

Soils on Kyushu are similar to those noted in the northern green pheasant range but are more acid due to higher rainfall conditions.

Prior to 1900 the southern green pheasant was introduced into Hawaii from Japan. Two regions of present-day concentrations of this pheasant are the windward slopes of Mauna Kea and Mauna Loa, Hawaii. Description of this habitat is taken from Schwartz (17):

"Green pheasant thrive best on the better soils in moist, open forests. Although they occur in all extreme elevations where ringnecks are found, areas of concentration lie mostly between 4,000 and 7,500 feet. Here temperatures are generally cool with an annual mean between 50° and 60°F. Topography is gently sloping. All occupied areas lie adjacent to regions of very high rainfall although the amount falling annually in specific ranges varies between 125 inches at lower elevations and 20 inches at higher limits. A general characteristic of the best green pheasant range is frequent mists, sometimes for days at a time, so while rainfall is not always heavy the amount of moisture is great.

"High densities occur where cover consists of scattered clumps of koa trees interspersed with grassy meadows containing mixed herbaceous growth; populations thin out in open grasslands, sugar-cane lands, or denser forests. Heavy grazing has been responsbile for opening much of the forest into grassland. In densely-forested portions grazing at present is creating more desirable green pheasant range, but in regions with optimum interspersion now, continued grazing will tend to prevent tree reproduction and hence reduce habitable range. We believe the green pheasant is decreasing through hybridization since its more restricted distribution and lower numbers tend to favor the ringneck."

It is interesting to note the lack of association of green pheasants with agricultural crops; this also applies to the ring-necked pheasant in certain prime population areas of Hawaii. In that State the green pheasant does well where grasses, legumes, and other herbs are common and where soils are fairly fertile and neutral or slightly acid.

Climatic Comparisons

A wealth of meteorological data has been compiled representative of the ranges of the green pheasants of Japan. Figure 14, after Nuttonson (13), depicts a map of Japan illustrating thermal and latitidinal analogues of this country to areas in North America. As green pheasant are not native to the northern Japanese island of Hokkaido we are concerned only with their ranges from Honshu south to Kyushu. This map also takes into consideration the North American regions most closely resembling the high annual precipitation and high humidity areas characteristic of Japan.

Figure 13. Habitat of the green pheasant on the lower slopes of Mauna Kea, Hawaii

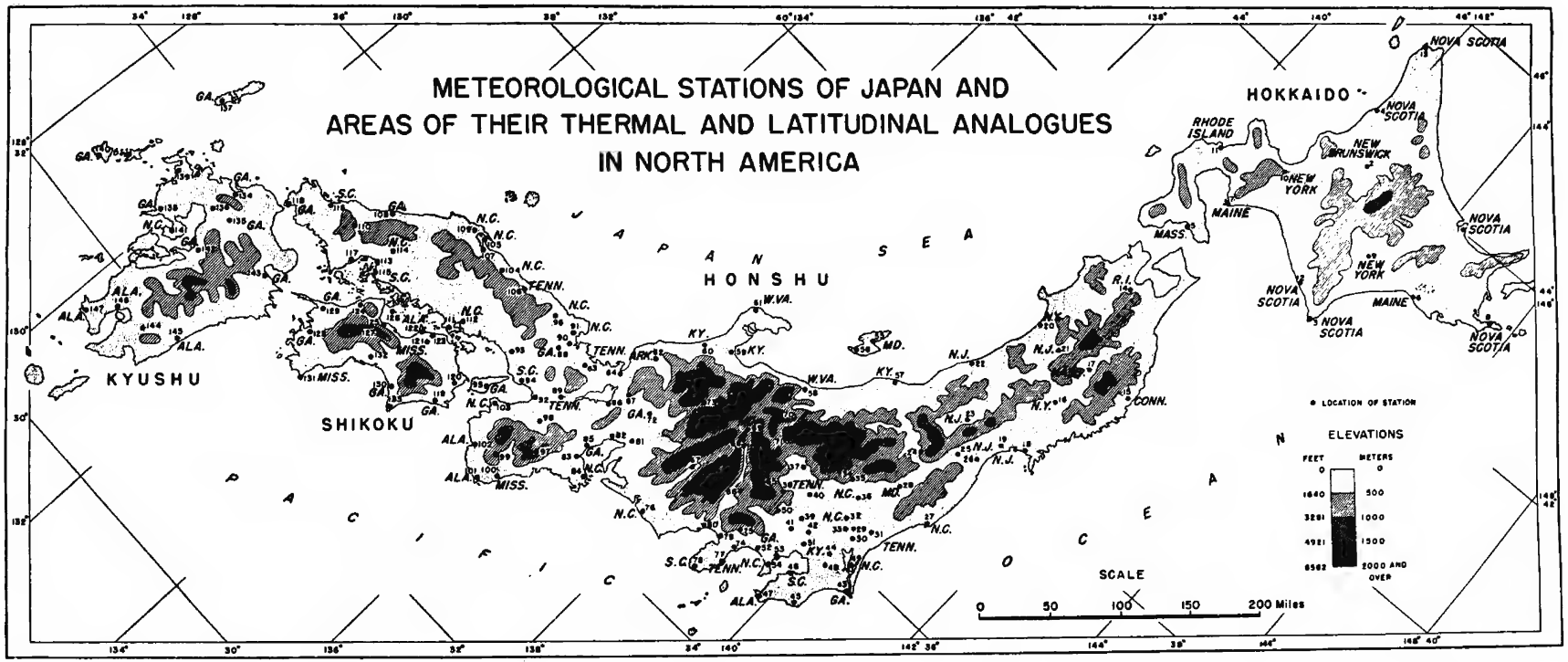


Figure 14. Northern, central, and southern areas of eastern United States with climate, latitude and, in many cases, topography similar to that found in green pheasant ranges of Japan. (Map from Nuttonson (13)).

By projecting the green pheasant's association with the various climatic areas in Japan, one can visualize this bird's climatic counterparts in portions of eastern and southeastern United States. Certain State names are not shown on the map, but, on a more limited seasonal basis, the northern green pheasant might also find suitable habitat in western portions of the Pacific Coast States. Sado Island and central Honshu both have climates similar in many respects to portions of Maryland. Differences include more precipitation in Japan, while springtime is mostly cooler and the remainder of the year warmer in Maryland. The most similar Japanese year-around thermal analogues, taking into consideration the lower annual precipitation, are found at Frostburg and Easton, Maryland. Princess Anne, Maryland, has cooler spring weather and the remainder of the year usually is warmer than Japan. It lies approximately 60 miles north of Virginia's northern green pheasant release area on Cape Charles.

In the eastern and northern portions of the United States the northern green pheasant would possibly find its comparable climatic needs from lower New Jersey southward into South Carolina. Coastal wooded areas adjacent to agricultural lands such as are found on Cape Charles would appear to be excellent for trials. Inland areas in the above States, including Tennessee and Arkansas, where the ring-necked pheasant has not been successful, might also offer suitable habitat and climatic conditions. The Appalachian and the Blue Ridge Mountains, at lower elevations where there is some agriculture and suitable escape cover, would appear attractive for this bird.

The northern green pheasant also should find suitable climatic and topographic conditions in western portions of Washington, Oregon and California, based upon the winter precipitation period of October to April.

In southern green pheasant range on Kyushu, mild summer and winter weather conditions are comparable to areas in the southeastern United States such as portions of North Carolina, South Carolina, Georgia, Alabama, Mississippi and Louisiana.

Japan experiences heavy precipitation throughout most of the year with northern Honshu southward to Kyushu receiving annually between 40 to 80 inches or more. Figure 15 gives average annual precipitation for Japan. In Tables 1 and 2 are presented mean annual temperatures and average monthly precipitation in the ranges of the northern and southern green pheasants.

Northern Honshu, when compared climatically to southern Japan, has lower rainfall, warmer more humid summers, colder winters and more snow. More southerly Kyushu has higher yearly rainfall, warm to hot humid summers with mild winters and no snow. August is generally the month of highest mean temperatures, and January is normally the coldest month.

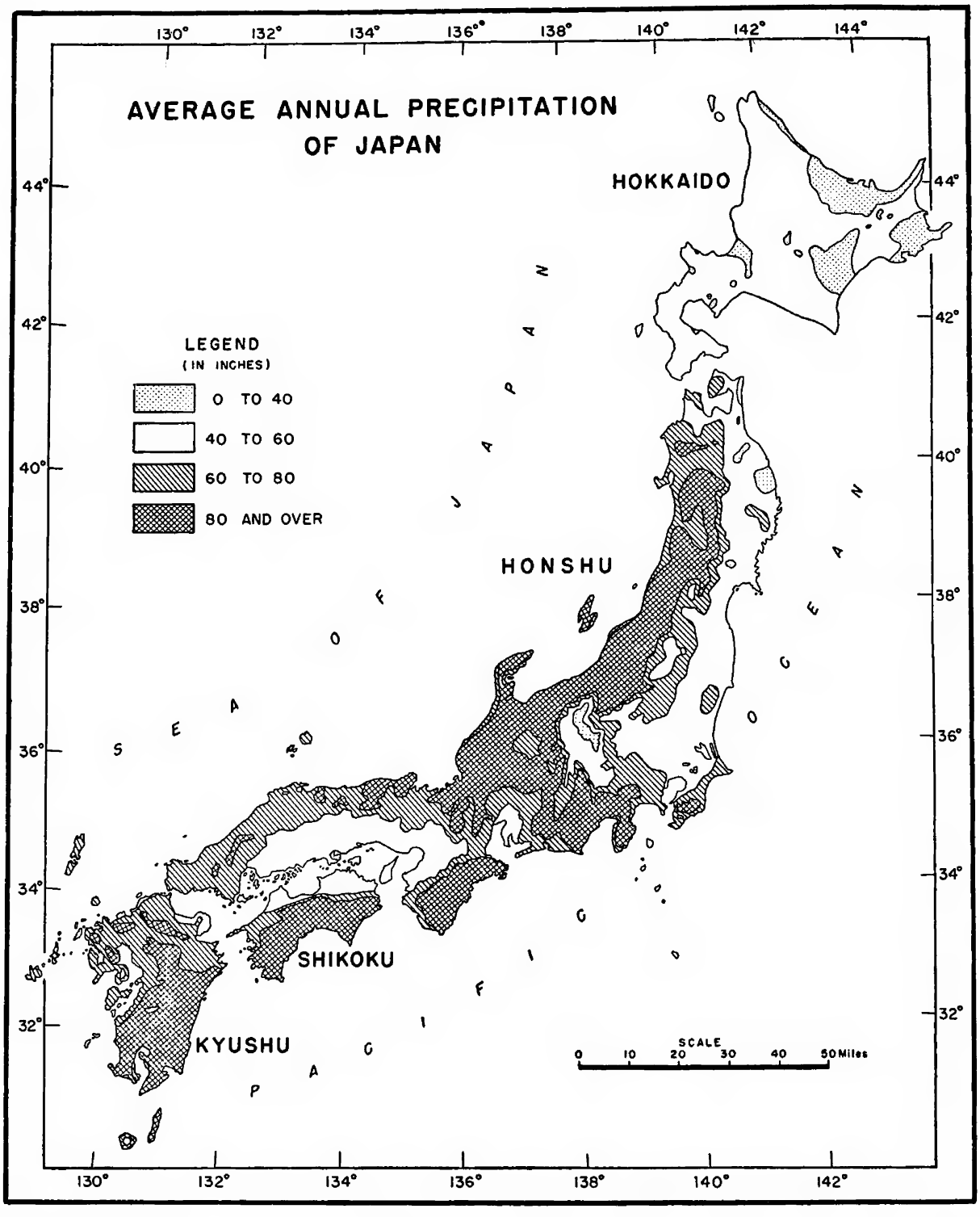


Figure 15. Average annual precipitation in the ranges of the green pheasant of Japan. (Map reproduced by permission of M. Y. Nuttonson (13).

Table 1. Range of mean annual temperatures occurring in portions of green pheasant habitat in Japan

Area	Coldest month	Warmest month
Northern Honshu	25°F to 36°F	72°F to 77°F
Central Honshu	33 to 45	68 to 82
Southwestern Honshu	35 to 45	78 to 82
Shikoku	31 to 46	72 to 83
Kyushu	39 to 46	79 to 83

At the meteorological station of Morioka in Iwate Prefecture of Northern Honshu a maximum temperature of 99°F. and a minimum of 0°F. have been recorded. Slightly more northern stations have recorded lows of -13°F. In southern green pheasant range near Kagoshima, Kyushu, a temperature of 97.2°F. and a low of 19.9°F. have been recorded.

In northern Honshu the mean annual temperature is below 54°F. Here snow cover lasts over 80 days on the ground, most of which falls between December and February. From central Honshu southward, milder mean annual temperatures of 54°F. or above occur while snow rarely falls in these southern latitudes. The precipitation often is higher than in northern Honshu, ranging between 40 to 100 inches annually. September is the month of heaviest moisture throughout most of Japan.

It is reported by wildlife officials in northern Honshu that wet, cold weather, occurring after the chicks have hatched in May, has caused higher than usual mortality. High relative humidity during the nesting periods is common in the range of the green pheasant, varying during May and June from 71 to 76 percent in northern Honshu. Relative humidity in southern green pheasant range during January and April normally extends from 72 to 75 percent.

This climatic pattern of temperatures and precipitation for Japan is similar to that experienced in the 40- to 60-inch rainfall areas of eastern and southeastern United States. Here the main season of rain is normally June to August; summers are hot and humid and winters are cold to mild, the latter in the more southern States.

Climacurves for northern green pheasant range on Honshu are presented in Figure 16. These comparisons, covering four selected seasons of the year, present the mean maximum and mean minimum temperatures in relation to precipitation for each three-month period. Smoothed curves drawn for each seasonal period represent the upper and lower limits of mean maximum and mean minimum temperatures in relation to the amount of precipitation.

Table 2. Average monthly precipitation in inches in the ranges of the northern green and southern green pheasants of Japan

Island area	Weather station	Altitude (feet)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yearly
Northern Honshu															
Iwate	Mizusawa	208	2.5	2.5	2.7	3.3	4.1	4.8	5.8	5.8	6.2	4.3	3.4	2.8	48.2
Prefecture	Morioka	416	2.1	1.7	2.8	2.2	2.7	2.8	4.4	6.3	5.0	3.7	3.3	3.0	40.0
Miyagi															
Prefecture	Isinomaki	148	1.6	2.0	2.9	3.8	4.6	4.6	4.8	4.3	6.4	5.3	2.6	1.6	44.5
Sado Island	Sendai	131	1.3	1.3	2.3	6.0	5.3	3.9	3.6	4.4	6.0	5.7	2.7	2.0	44.5
Nigata	Aikawa	148	5.2	4.2	4.1	4.3	3.7	4.0	6.0	3.7	6.7	6.1	6.5	6.8	61.3
Prefecture	Hamochi	-	4.6	4.2	3.7	2.4	3.1	2.5	4.5	2.1	4.0	5.0	6.4	5.0	47.5
Central Honshu															
Kanagawa	Chigasaki	36	2.4	3.2	4.6	5.2	6.4	8.0	5.9	9.7	10.9	7.2	3.3	2.0	68.8
Prefecture	Yokosuka	38	2.9	3.7	5.7	6.8	7.0	7.9	6.7	7.9	10.9	9.1	4.7	2.9	76.2
Yamanashi	Ochiai	3687	1.9	3.3	4.2	4.7	6.2	8.1	8.7	10.4	12.6	7.8	3.7	2.3	73.9
Prefecture	(Kai) Kofu	853	1.4	2.1	2.9	3.3	3.7	5.0	5.5	7.0	7.8	6.0	2.6	1.7	49.0
Kyoto	Kyoto	142	2.1	2.6	4.0	5.5	5.5	9.3	7.4	5.6	7.6	5.1	3.0	2.1	59.8
Prefecture	Maizuru	102	7.8	6.4	5.9	5.0	4.4	6.9	6.3	7.5	9.7	8.2	5.4	7.2	81.1
Hyogo	Kobe	191	1.6	2.1	3.4	4.7	4.7	7.6	6.0	5.2	7.0	4.8	2.8	1.8	51.7
Prefecture	Sumoto	368	2.0	3.2	3.7	4.3	6.1	7.8	7.0	5.2	9.5	5.0	3.6	2.4	59.8
Kyushu															
Miyazaki	Miyakonojo	466	2.7	3.2	5.9	7.9	7.9	16.9	13.3	10.9	8.8	5.4	3.1	2.2	88.2
Prefecture	Miyazaki	27	2.9	4.3	7.5	9.0	9.5	15.5	12.0	11.3	11.7	8.7	5.1	2.8	100.3
Kagoshima	Kagoshima	18	3.4	4.0	6.4	8.7	8.2	17.0	12.2	7.4	8.7	5.2	3.7	3.4	88.3
Prefecture	Makurazaki	112	2.7	4.2	4.6	6.5	8.1	12.3	8.5	5.2	7.4	2.9	4.7	5.5	72.6

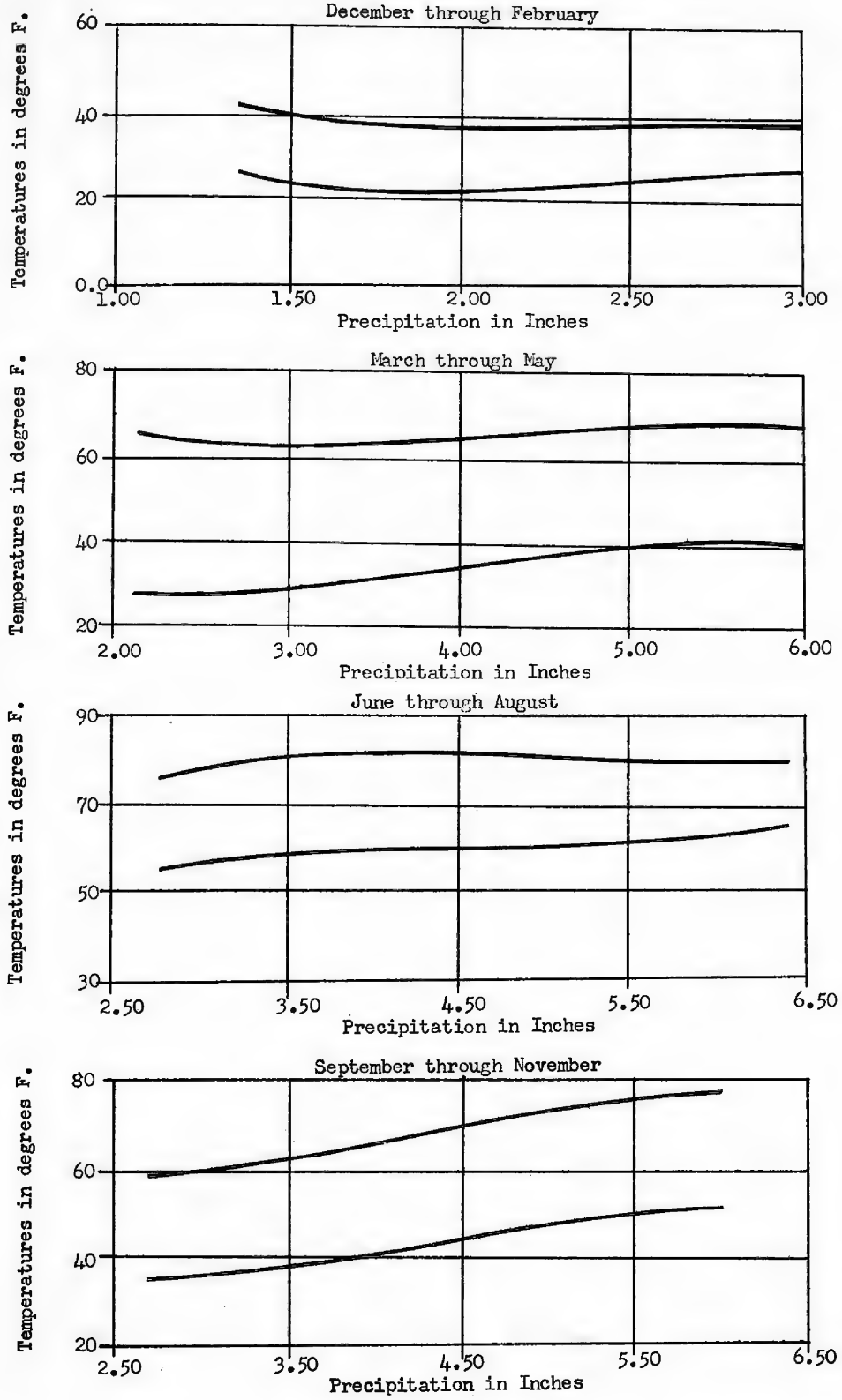


Figure 16. Mean maximum and mean minimum temperatures in relation to precipitation in northern green pheasant (Phasianus versicolor robustipes) habitat of Japan covering the four seasons of the year.

Food and Water

Green pheasants are omnivorous feeders. So far as is known, their food is similar to that of the ringneck with possibly somewhat greater dependence on wild seeds, fruits, berries and nuts. Grains taken from farmlands are often those which can be gleaned from these areas. Vegetable material frequently represents the bulk of their yearly food while insects are taken whenever they can be procured. Young pheasants rely heavily on insects in their early summer diet.

Green pheasants feed morning and evening near agricultural fields and also visit tea plantations and open grasslands in search of their food. Small numbers are normal for feeding parties.

Information from the Japanese Wildlife Section indicates that the northern green pheasants take both vegetative and animal matter from about April to September, after which they gather mainly vegetative food from the vicinity of farmlands. Tree and shrub species utilized for their fruits include Rosa multiflora (fruits), Euonymus sieboldiana (fruit), Viburnum dilatatum (fruit), Viscum album var. lutescens (mistletoe berries) and Diospyros lotus (small persimmon fruit).

Acorns are taken from species of Quercus, also seeds of Japanese magnolia (Magnolia spp.) and chunks of chestnuts (Castanea crenata) are eaten, as indicated from stomach contents of a specimen obtained in Kyoto Prefecture, Honshu. This male pheasant was collected May 20, 1950 by Heitaro Yonezawa and C. M. Fennell.(a) The latter also reported that three additional green pheasants collected in winter had eaten red beans, rice, and green tender sprouts of some sort similar to clover, green succulent leaves, wild rose seeds and white quartz pebbles.

In a recent communication, (b) Mr. Toyo Matsuo notes that according to the Wildlife Section some foods taken by the southern green pheasant are similar to those eaten by the northern green pheasant. These foods are listed below.

In addition to cultivated millet, wheat, barley, and rice listed below, other cropland products gleaned by green pheasants may include soya bean, buckwheat, and sweet potatoes. The birds are considered useful in the protection of forests since they take so many potentially harmful insects.

The high precipitation in Japan occurring throughout the year usually provides readily available water for pheasants. Flowing streams, heavy dew, green succulent vegetation and insects, also assure moisture during the year.

(a) Field notes of C. M. Fennell.

(b) Forestry Agency, Tokyo. Letter July 2, 1963.

Plants	Common Names
Polygonum sp. (seeds and leaves)	knotweed
Rosa sp. (fruits)	rose
Panicum spp. (seeds and leaves)	witch grass
Rhus sp. (berries)	sumac
Euscophis japonica (capsules)	- -
Staphylea bumalda (capsules)	bladdernut
Euonymus alata (drupes)	euonymus
Euonymus sieboldiana (drupes)	siebold euonymus
Lespedeza spp.	lespedeza
Weigela spp.	weigela
Setaria spp. (seeds and leaves)	millet
Triticum aestivum (seeds and leaves)	wheat
Hordeum vulgare ssp. (seeds and leaves)	barley
Oryza sativa	rice

Animal Material	
Coleoptera	beetles
Hymenoptera	bees, ants, wasps
Lepidoptera	moths and butterflies
Hemiptera	sucking insects
Orthoptera	grasshoppers
Diptera	flies
Diplopoda	millipeds
Crustacea	crustaceans
Gastropoda	snails

General Habits

Movements and Mobility

Most green pheasants are resident and sedentary in their habitat. Little population movements occur except in the higher snowfall areas of northern Honshu. Earlier reports by Beebe (5) and Taka-Tsukasa (18) cite January downward movements of groups of 50 to 100 or more green pheasants from high plateaus or mountains to lower levels and the seashore during severe winter weather. No similar pheasant movements have been reported for southern Japan since mild weather prevails there in winter.

Birds return to their favorite habitat areas following the evaporation of the larger snow drifts, if they have moved to lower areas. Deep snow may force the birds to seek food from stacks in the vicinity of human habitations, from trees or bushes or, in dire necessity, to feed in farmyards with domestic fowl, according to Taka-Tsukasa (18).

Daily movements usually start with small numbers of pheasants leaving the hillside roost early in the morning. A downward move soon puts the pheasants in or adjacent to croplands or grassy areas where they feed. (a) After feeding, movement is back to the grass or brushy hillsides for resting and dusting. In the afternoon the pheasant again walks downward to the feeding areas, thence back up the hillside to the evening roost.

Flight and Wariness

Japanese green pheasants are fast fliers and wary birds. A hunter should utilize good dogs to locate them. When flushed they tend to fly sharply upward 15 to 30 feet, then either horizontally along the hillside or toward the nearest hilltop. After reaching sufficient flying speed they often glide to a place of escape. Birds fly from their hiding places by one's or two's.

American hunters stationed with the armed forces in Japan consider green pheasants faster in flight and more wary than the ring-necked pheasants. This combination provides ample challenge to the sportsman. The green pheasant is less a speedster than the copper pheasant, which when flushed uses its 25- to 30-inch tail to guide its flight down a canyon at deceptively fast speeds.

Resting and Roosting

Following the morning feeding period the green pheasant rests on the ground on hillsides, preferably in sandy areas where dusting also occurs. Other resting areas may be under thick undergrowth in sparsely wooded deciduous-type forests.

About sundown the green pheasant seeks out its roost site by walking up the hillside, preferably to a grassy area at or near the hilltop. Lacking this type of cover, the birds may utilize more brushy but open types of vegetation. Roosting normally is on the ground, but Taka-Tsukasa (18) also reports it in trees.

Nesting and Renesting

Green pheasant nests are often found close to low bushes or at bases of trees. Some are also placed in or at the edges of cultivated fields or along brush or forest edges. They are found from sea level to around 3,000 feet. Figure 17 shows a female green pheasant incubating seven eggs on a nest located in low bamboo plants. The second photograph shows ten freshly hatched chicks. This nest was found in central Honshu above 2,600 feet elevation on the lower slope of Mt. Fuji.

According to Taka-Tsukasa (18) clutch sizes range from 6 to 12 eggs with as high as 15 reported.

(a) Information from Mr. Kawamura, Iwate Prefectural Game Warden, Morioka, Japan

Nesting activities in northern Honshu may begin in early April and as early as January for the southern green pheasant in Kyushu. In northern Honshu, egg-laying occurs around April 25 according to the local wildlife official. (a)

Renesting occurs if the first nest is disturbed or destroyed and often results in second or later clutches appearing from late June into August.

Eggs

The eggs are small, varying in color from brownish to greenish-gray. Egg sizes as noted by Austin and Kuroda (4) average 43 x 35 mm. The female alone incubates the eggs in the wild for a period of 23 to 25 days.

Brooding and Rearing

As soon as the chicks are hatched and dry they leave the nest with the mother. She is a strong protector of her young and broods them until they become too large to fit under her wings. After 8 to 10 days young birds are able to fly short distances. Young remain with the mother for about three months.

Insects are avidly taken by all young growing birds, and water is no problem in Japan due to high monthly precipitation and humidity.

Gregariousness

Normally only small groups of adult male and female pheasants are found living in close proximity to each other. At the commencement of breeding in the spring each year, one male and one or more females may be found together in their selected breeding territories. Following the nesting period the cock pheasants may rejoin the female and her brood or may flock with other male birds during late fall or winter.

Psychology and Behavior

When found close to human habitations in Japan, green pheasants tend to be shy and to hide quickly when approached. They are not as wild as the copper pheasant either in the field or in game farms.

During the breeding season, male pheasants claim and defend their territory against all other potential male breeders. Fights between male birds seldom result in death; one bird usually retreats.

(a) Information from Mr. Kawamura, Iwate Prefectural Game Warden, Morioka, Japan

Figure 17. Female green pheasant on her nest. (Photo by Keisuke Kobayashi, Kobe)

Figure 18. Nest with chicks just hatched found on lower slopes of Mt. Fuji. (Photo by Keisuke Kobayashi, Kobe)

Male green pheasants crow in alarm at loud explosive noises such as thunder or gunfire. Earthquakes also trigger an immediate crowing response from male birds, as also occurs with the ringneck in Stateside coverts. The Japanese people credit the green pheasants with the ability to foretell earthquakes since they often crow at slight tremors, too gentle for humans to feel, such as frequently precede large earthquakes.

Calls

It is reported that the male crowing calls during the breeding season are shorter and somewhat different than are those of the ringneck. Cackle-like calls are heard when flushing a hiding bird or when loud noises or earthquake tremors occur.

The early naturalist Beebe (5) said in reference to the green pheasants: "The cocks are untiring in their challenging in early spring, and so omnipresent was this sound that, when the broken crow comes to my ears from one of our Eastern fields or from the runway of a Zoological Garden it is always the memory of some Japanese landscape which the sound revives."

The female is normally silent but keeps her young chicks together with low calls similar to those used by ringnecks in communicating with their young.

Interbreeding

It has been observed on Honshu and Kyushu by Austin and Kuroda (4) that the ringneck interbred freely with native wild green pheasants but that the resulting F_1 generation hybrids shortly disappeared. Almost none of the ringneck strain remains today in islands south of Hokkaido.

Austin and Kuroda offer recent interbreeding considerations for the green pheasants and ring-necked pheasant group when they note: "Yamashina (1949) considers versicolor conspecific with colchicus because he found the F_1 hybrids between the two to be 'totally fertile'. While this may be true in the breeding pens and in the laboratory, it does not agree with the earlier observations of the crossing of these two forms in the wild which showed the hybrid offspring of the Green Pheasant-Ring-necked Pheasant cross to be only partially fertile." Recent reports from Tennessee and Ohio game department personnel indicate that they find F_1 hybrids of green pheasants and ringneck pheasants to be fertile.

Prince Taka-Tsukasa (18) states the green pheasant is occasionally reported to cross with the copper pheasant. Because of crosses such as this the Japanese Ornithological Society (15) has reclassified the copper pheasant from Syrmaticus soemmerringii to Phasianus soemmerringii.

Predation

Predators of avian species in Japan are similar to those found in the United States. Most common are hawks, crows, ravens, magpies, weasels, and snakes, all of which may take a share of pheasants or their eggs. Considered the greatest enemy of the game birds in Japan are feral cats and dogs. No direct signs of predation were noted by Foreign Game Introduction Program personnel in Japan, but illegal wire snares and nets for taking pheasants were in evidence.

Reproductive Capacity

Little difference has been noted in reproductive capacity between Japanese green and ring-necked pheasants.

Breeding age -- Young pheasants breed the year following their hatching.

Number of eggs -- Average clutch size ranges from 6 to 12 eggs. As high as 15 eggs for one nest have been reported.

Brood survival -- Usually good in Japanese habitats.

Life span -- In the wild may live an average of 2 to 3 years. May live 8 to 10 years in captivity.

Sex ratio -- On the average, one male to 2 or 3 hens in the wild.

Renesting -- No authentic second broods reported. Late broods, resulting from earlier-destroyed first nests, may lead some observers to report second broods.

Diseases and Parasites

Green pheasants are normally no more susceptible to diseases of domestic fowls than are the ring-necked pheasants. According to Japanese Government veterinarians diseases that have been contracted under game farm conditions in Japan have included fowl cholera, pullorum, and, more rarely, Newcastle disease.

Analysis of Competing Interests

Relation to Agriculture

Japanese green pheasants exhibit much the same relation to agriculture as do the ringnecks in the United States. Although closely associated with croplands in Japan, the damage to agricultural crops by green pheasants has usually been exaggerated, according to wildlife and

forestry officials who have studied this bird's food habits. Usually the green pheasants glean waste or fallen crop products from fields, and except when their numbers might become over-numerous, little economic loss occurs. As only one-sixth of Japan's land area is under cultivation it is understandable that the slightest loss of food to pheasants may bring protests from farmers.

As ardent hunting enthusiasts, the Japanese usually hold down the green pheasant populations. Forestry officials praise the green pheasant for taking so many insects which are potentially dangerous to forest trees.

Usefulness

As a source of food -- Green pheasants are excellent tasting, white-meated birds. Young birds are tender; old cocks may be on the tough side if not properly aged after shooting, but are similar in quality to the ring-necked pheasants. They may seem slightly dry to the more particular gormandizer.

Trapping by mist nets, wire traps and snares brings some pheasants to the markets during winter months in Japan. Considered a delicacy, some birds apparently are shipped long distances to markets in cities such as Yokohama and Kobe.

As fighting birds -- They are usually shy and non-aggressive except during the breeding season when male birds defend their territories. Green pheasants have not been trained as fighting birds as have junglefowl.

As a game bird -- Green pheasants are probably the most popular game bird in Japan and a challenge to all who hunt these wary birds. Dogs are often used to flush them since the green pheasant tends to hold to cover as long as possible.

On overgrown hillsides, sometimes impenetrable for hunters, birds flushed by dogs offer quick shots as they emerge over the brush. In sparse forest and brushy areas one is reminded of hunting ruffed grouse because of the manner in which the green pheasants swerve and fly low through the forest canopy.

In northern Honshu near Morioka, a hunting party of three with two hunting dogs bagged five green pheasants and three copper pheasants in two days. This was in January with more than 12 inches of snow on the ground with temperatures ranging from 10° to 32°F. during the day.

The usual procedure is to hunt the ridge roosts early in the morning, then the sunny resting grounds during the later daylight hours. Finally, the hunting is in and around farm lands near the evening hillside roost.

Properly protected in Japan the green pheasants would appear able to maintain good population numbers. However, since hunting pressure has intensified during the past twenty-years, the Wildlife Section in Japan has increased releases of game-farm pheasants in many areas.

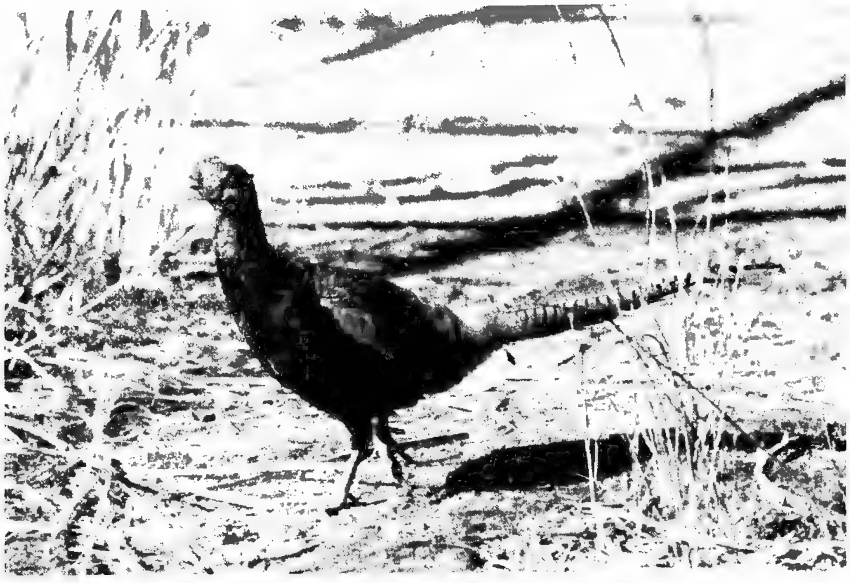


Figure 19. The wild green pheasant is a game bird of first rank. (Photo by Wildlife Section, Ministry of Agriculture and Forestry, Japan)

Figure 20. The Japanese hunter avidly pursues the green pheasants and fares best with use of a good dog.

Hunting take figures, given by Austin and Kuroda (4), indicate about 400,000 green pheasant per year were taken up to 1928; approximately 300,000 in the late 1930's; in 1946 a harvest of 486,000; in 1947 it was down to 319,000. The Wildlife Section reported an increased kill of about 479,000 green pheasants in 1962.

Competition with Other Game Species

Two other upland game birds overlap the range of the green pheasant in Japan. At lower elevations the Chinese bamboo partridge is found while the copper pheasant occurs at the upper elevations of the green pheasant range. Little competition between these game birds for food or territory has been reported.

Introduced from China about 1919, the Chinese bamboo partridge (Bambusicola thoracica thoracica) overlaps the range of the green pheasant at the lower elevations. It thrives best in the warm areas of high rainfall where sparse forest and brush growth or bamboo thickets offer food and shelter adjacent to cultivated plains or mountain valleys.

A second game bird, the copper pheasant (Syrmaticus soemmerringii), according to Austin and Kuroda (4), is limited to Honshu, Shikoku and Kyushu ranges in mountain forests and canyons up to 4,500 feet. It occurs down to near sea level in rugged hilly country and usually shies away from human habitations or cultivated fields. It prefers the dark Japanese redwood or cypress forests with a mixture of shrubby woods and grassy hillsides. It is in the lower elevations from about 1,000 to 3,500 feet that the green pheasant may overlap it in habitat.

There should be no greater competition between Japanese green pheasants and bobwhite in the United States than there is betwen ringneck and quail, or ringneck and ruffed grouse. Northern green pheasants in our eastern States have sometimes been liberated where coverts are partially occupied by bobwhite. Little serious competition has been reported to date between these two game birds.

Breeding and Raising

After a slow start, State game farms have found that the Japanese green pheasant is almost as easy to propagate in captivity as is the common ringneck. As is normal with wild-trapped stock, special attention was required to secure good egg production until a few generations had been produced in captivity. Thereafter the same techniques, successfully employed in producing ringnecks in captivity, were found to be applicable also to green pheasants. Normally 1 male to 4 or 5 females are penned together at breeding time. An average of 40.6 eggs per hen was secured on the Virginia State game farm in 1962 from breeders that were only two generations removed from the wild. Fertility has been high. The incubation period for these eggs is 23 to 24 days in captivity. Incubator

temperatures and humidity for Japanese green eggs are, apparently, the same as for ringnecks. No unusual problems have been associated with the brooding or raising of the young. Between 1960-1963 a total of 7,618 Japanese green pheasants are reported to have been raised, mainly for trial release, by four States (7).

There is considerable indication that these pheasants in captivity begin egg production from 2 to 3 weeks later than do our northern ringnecks. If this characteristic is confirmed by further field studies of released birds it could prove important in reducing nest losses, such as those commonly associated with early mowing, among our northern ringnecks.

The survival in the wild of farm-reared birds may be more dependent upon liberating individuals well raised and conditioned, than is generally realized. Considerable progress in producing these birds on a quality rather than a quantity basis is evident on a number of the State game farms that are working with the Foreign Game Introduction Program.

KOREAN AND MANCHURIAN RING-NECKED PHEASANTS

The group of true pheasants includes both Korean ringnecks and Japanese green pheasants. Two subspecies of the Korean pheasant are recognized. The Manchurian ringneck (P. c. pallasi) inhabits North Korea and the mainland in eastern Manchuria largely north of the 38th parallel. The South Korean pheasant (P. c. karpowi) is resident south of the parallel in Manchuria and South Korea.

Both Korean and Japanese green pheasants are included in this report. This is in part because of similarities in their life histories and habitats, in part since they are the only two pheasants resident in eastern Asia to be studied by Foreign Game Introduction personnel to date. Both have many characteristics in common with ringnecks in the United States. Both are agricultural land species but they also thrive, to a greater extent than do our ringnecks, in the brushy or wooded coverts adjacent to cultivated valleys or uplands. Korean and, to a lesser extent, northern Japanese green pheasants occupy ranges characterized by wide variations in temperature and in precipitation and by considerable snow in winter. Of the two species, the Korean pheasant is adaptable to the colder climate, the Japanese green to a more humid one. The climatic pattern within the range of the Japanese green pheasant is predominantly peninsular in character; whereas the Korean subspecies survives under both peninsular and continental types of climate.

In their native range in Asia no other true pheasant is found as far north as the Manchurian, and only a few other subspecies are distributed at latitudes equal to that of the South Korean pheasant. Thus it is understandable that some States north of the Mason and Dixon line would be interested in the possibility that one or both of the pheasants mentioned above might prove adaptable to potential pheasant habitat not now adequately occupied by the introduced ringneck. Consideration of this possibility has, to date, been limited to the South Korean ringneck. About 50 of these birds were secured in 1960 and were distributed, as breeding stock, to 5 State game farms. Efforts to secure wild-trapped Manchurian pheasants are being continued.

Taxonomy and Distribution

According to Delacour (8) the true pheasants are represented by 31 subspecies of the genus Phasianus. He further subdivides these into several groups. The Korean-Manchurian pheasants belong to the gray-rumped group which is composed of 18 subspecies, distributed from Mongolia, Manchuria, China and Korea to Formosa.

This report is concerned largely with the pheasant that is resident in South Korea and southern Manchuria. Delacour calls this bird the Korean ringneck (P. c. karpowi) but indicates that, between latitudes 37° and 40°N., in Korea there exists an unstable population intermediate in

characteristics between P. c. karpowi and the Manchurian ringneck (P. c. pallasi). Thus, on the Korean peninsula, most of the range of pure P. c. karpowi appears to lie in South Korea. The name South Korean ringneck has accordingly been utilized here for this subspecies.

Delacour presents the following taxonomy and distribution for the Korean-Manchurian pheasants:

Order	Galliformes
Family	Phasianidae
Genus	Phasianus
Species	P. colchicus

Subspecies

P. c. karpowi	South Korean ring-necked pheasant	Northeastern Chihli; southern Manchuria and Korea, mainly south of the 40th parallel; Cheju Do and Tsushima islands
P. c. pallasi	Manchurian ring-necked pheasant	Southeastern Siberia from the upper Amur and Ussuriland south of lat.44°N., south to northern Chihli and central Manchuria

Introductions

According to the 1957 check-list of North American Birds (2) the ring-necked pheasant now established in the United States has come from China, supposedly P. c. torquatus, and from England, where the races colchicus, torquatus, and others have been introduced and have mingled. In the eastern and central United States Gardiner Bump (a) believes that the major addition has been P. c. mongolicus. There is no indication that sizable numbers of the Manchurian or of the Korean ringnecks were added to the ringneck stock in the United States prior to 1959.

Delacour (8) noted that P. c. karpowi was bred in captivity in 1926 at Cleres, France, that some of the birds raised were released, but that no pure stock subsequently has been preserved. This subspecies was also introduced into Japan in 1919 by the Bird and Mammal Experimental Station of the Ministry of Agriculture and Forestry. Game farm propagation was followed a few years later by releases into the wild. By 1930 this pheasant had been liberated in many prefectures of Honshu and Kyushu and is reported to have interbred freely with the native green pheasants. The pure ring-necked pheasant strain lasted only a short time and few remain today in the southern Japanese islands.

Of particular interest, however, was the release of the Korean ring-necked pheasant on the northern Japanese island of Hokkaido as reported by Austin and Kuroda (4):

(a) Personal communication.

"In Hokkaido, where there are no indigenous pheasants to breed it out, the ring-neck has been more successful. It was first released in pasture lands at Urakawa and Oshamambe on the south coast in October 1930. More were planted in these same places in 1931, and around Uchiura Bay as well. In all only about 300 birds were released, but they thrived and after 1935 began to spread. By 1940 the Urakawa planting had spread westward to Tomakomai, and by 1944 south to Noborobetsu, north to the Oiwake-Yuni district, and eastward past Cape Erimo into the Hiroo-Ikeda district. Some crop damage was reported south of Sapporo, and a short open season was allowed the winter of 1943-44. The stock decreased so rapidly that complete protection had to be resumed immediately. Occupation troops accounted for so many between 1946 and 1950 that the bird is no longer plentiful, but a stock still remains along the south coast of Hokkaido where the winters are mild enough for it to survive. With continued protection and additional plantings when necessary to keep the stock vigorous, it should eventually populate the farm lands of this area from which the Hazel Grouse has been driven by cultivation."

THE SOUTH KOREAN RING-NECKED PHEASANT
(Phasianus colchicus karpowi)

The South Korean ringneck is the most widely hunted upland game bird throughout its habitat in Korea. As a result of the Korean war, the attention of many Americans stationed in South Korea has been directed to this subspecies. Foreign Game Introduction Program biologists have long been interested in the possibilities of extending pheasant ranges in the United States through successful trial releases of subspecies of P. colchicus not previous tested. Accordingly a brief, on-the-spot study of this ringneck was conducted in 1958-1959. The current report is based on the information thus obtained supplemented by a thorough review of available literature pertaining to the South Korean ringneck.

Common Names

A variety of local names has been listed for this pheasant. Those most commonly used follow:

Korean ring-necked pheasant	English
Southern Korean ring-necked pheasant	English
Southern Corean ring-necked pheasant	English
North China ring-necked pheasant	English
Corean pheasant	English
Tsushima pheasant	English
Ring-necked pheasant	English
Kwong	Korean
Kkuung	Korean
Chi	Korean
Yeh-chi	Chinese
Shan-chi	Chinese
Chu	Chinese
Korai Kiji	Japanese
Faisan Corean	French

Distribution and Relative Abundance

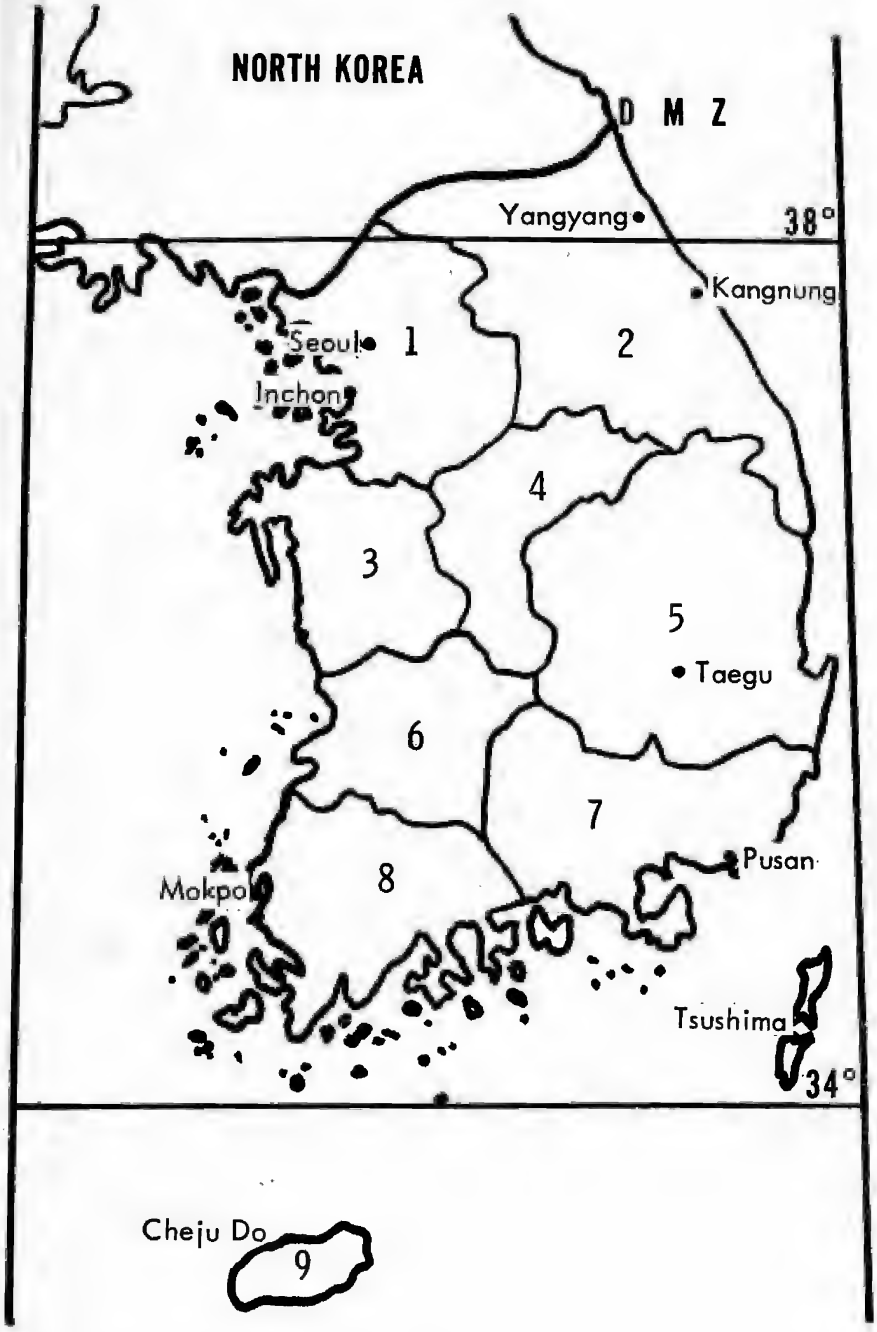
The range of pure P. c. karpowi in South Korea extends for approximately 250 miles from Cheju Do Island north through the Korean peninsula at about 37°N., into southern Kyonggi Do and Kangwon Do provinces (Figure 21). Between latitudes 37°N., to 40°N., the pheasant population is intermediate between P. c. karpowi and P. c. pallasi, the Manchurian ring-necked pheasant. Both subspecies live at moderate elevation ranging from sea level to about 2,000 feet or slightly higher.

Travel in the vicinity of the 38th parallel or "Armistice Line" between South and North Korea was highly restricted, so Program personnel were necessarily limited to field studies south of this area. Local reports from the above, heavily-mined area indicated that pheasants were very abundant partly because of lack of hunting and partly because of good food and cover conditions. Several of our Armed Forces personnel enticed to this general area by the abundance of pheasants have suffered serious accidents from land mines.

Farther south, along the east coast of South Korea between Yangyang and Kangnung, pheasants were so abundant as to provide four guns with about 25 birds a day. As many as 75 to 100 or more were flushed in one day by a party with one dog. Few hunters were seen along this particular coastal area. Inland, around Seoul, decidedly fewer numbers of pheasants were seen or flushed but hunting, nevertheless, was better than in many United States pheasant coverts. Larger pheasant numbers were located at some distance from big cities, but the South Korean ring-necked pheasant was common even in the brushy canyons and ridges in and around Seoul.

Pheasants were in such abundance on southern Cheju Do Island that the U. S. Armed Forces chartered recreational flights to provide excellent hunting for their personnel from both South Korean and Japanese bases.

No authentic records have been noted to indicate that the birds are cyclic or that they vary in population numbers any more than do our ring-necked pheasants. South Korea offers move favorable year-around climate and better habitat conditions, conducive to the welfare of this bird, than are found throughout much of the northern United States.



South Korean Provinces

1. Kyonggi
2. Kangwon
3. Chungchong, South
4. Chungchong, North
5. Kyongsang, North
6. Cholla, North
7. Kyongsang, South
8. Cholla, South
9. Cheju Do

Japanese Territory

Tsushima Islands

DMZ = Demilitarized Zone separating North and South Korea.

Figure 21 -- Map of South Korea, including Cheju Do and Tsushima islands, showing names of areas and cities referred to in this report.

Description

The major difference between the South Korean and the Manchurian ringneck subspecies, cited by Austin (3), is in coloration. The Manchurian ring-necked pheasant is a larger and paler bird, than the South Korean form whose darker color is associated with higher rainfall. South Korea with higher rainfall produces the darker P. c. karpowi. Minor color characteristics such as the width of the neck ring, the shade of the light stripe over the eye, and the white spot in the dark neck feathers, have been evaluated for both subspecies but none is definite except on inspection of a large series of skins. As is true with other Phasianus subspecies, many types of color variants are produced in the wild by the South Korean ring-necked pheasant.

The description given here follows Delacour (8) and serves to distinguish between the South Korean (P. c. karpowi) and Manchurian (P. c. pallasi) ring-necked pheasants, particularly where no intergrading has occurred:

South Korean ring-necked pheasant	Manchurian ring-necked pheasant
Male	
Smaller and darker colored; collar uninterrupted and wide in front; wing: 240-260 mm.	Larger and lighter in color; crown pale; white eyebrows and collar very wide and uninterrupted in front; usually a white spot on the cheeks; mantle straw yellow; scapulars light cinnamon-chestnut; rump pale grey; wing: 249-270 mm.
Female	
Darker colored and well marked	Light in color but well marked

Taka-Tsukasa (18) provides the following detailed descriptions of the male and female South Korean ring-necked pheasant:

"Adult Male

"Top of the head oily olive-green; forehead, face, throat and neck glossy dark-green, purplish-blue in certain lights. Superciliary stripe creamy-white, or white, beginning just above the eye and extending to the back of the ear-coverts. Lower neck broadly collared with white, and having another narrow dark-green collar immediately below it. Upper back, sides of breast, flanks and sides of abdomen ochreous-orange; the basal part of the upper-back feathers white, the border of which and the margin of the feather dark-green. These two green bands are connected with a dark-green shaft streak. The feathers of the upper parts of the

sides of the breast margined with dark-green, and the feathers of the lower parts of the sides of the breast, and abdomen having a large dark-green spot. Lower back and scapulars white, broadly margined with purplish-carmine. Between these two colours, there is a blackish band, glossed with dark-green, and also some dots and a center marking of the same colour exists. Rump olive-green, with buff and dark bluish-green markings at the base. Lower rump and upper tail-coverts olive-green; under side of the rump light columbia-blue; the side of the upper tail-coverts orange-rufous. Wing-coverts bluish-grey, nearly white at the bend of wing and tinged with olive on the inner parts. The feathers of the inner coverts, and tertiaries, broadly edged with brownish-maroon, and the latter having in addition a black centre dot, margined with olive-buff. Secondaries greyish-black, with white vermiculars dots and buffish-olive edge; primaries black, with some irregular bars.

"Breast fiery copper-red, narrowly edged with dark-blue; middle of the upper abdomen and whole of its lower parts black, glossed with deep-blue; under tail-coverts burnt sienna. Tail olive, with black bars, and greyish maroon on the side.

"Bill horny-grey, paler on the cutting edge; legs pale horny-grey; iris yellow (dark brown or dark hazel in the female)."

Wing: 232-257 mm.; tail: 424-596 mm.; culmen: 34-46 mm.; tarsus: 65-73 mm.

"Adult Female

'Forehead and top of the head black, with Van Dyke's brown edge and buff subterminal band; face, nape and breast brown, with a black edge and a bar, and the parts between the black edge and the bar next to it, rosy-buff with pale vermiculations of sepia colour; circumocular region nearly white, and ear-coverts Van Dyke's brown. Upper shoulder Van Dyke's brown, with consecutive black, buff and black bars at the tip, and a narrow glossy, purplish line encircling the buff bar. Lower shoulder, back, scapulars, rump, and upper tail-coverts dusky Van Dyke's brown, with black spots and buff margins; wing-coverts similarly patterned, but the brown and buff much paler than the back. Primaries dark-brown, with pale buff bars, changing to brown near the shaft; secondaries pale-buff, barred and dotted with black, and, between these bars and dots are also tinted with pale-brown. Tail dusky Van Dyke's brown, with black bars and dots, and a rusty-brown triangular spot above the black bars.

"Throat buffish-white; lower breast and abdomen pale ochreous-buff; flank pale-brown, with large black V-shaped speckles, broad margined of pale-buff."

Wing: 206-230 mm.; tail: 224-307 mm.; culmen: 32-38 mm.; Tarsus: 56-64 mm.

Size and Weight

The South Korean ringneck is larger than the ringneck originally introducted into the United States. Adult males weigh between 2 lbs. 12 oz. to 3 lbs., and females range from 2 lbs. to 2 lbs. 12 oz.

Habitat and Cover Preferences

The Korean peninsula is not large. With its adjacent islands, it consists of about 85,200 square miles. This is an area roughly the size of Minnesota, or Pennsylvania and Ohio combined. The general characteristic of Korean topography is one of mountains and hills interspersed with small river plains. The most rugged and the highest mountains are located in the northern third of the peninsula. Mountains generally are lower and less extensive in the south. Eastern and southern coasts are characterized by steep headlands which are occasionally separated by small alluvial plains created by rivers.

South Korean ring-necked pheasants occur as common residents from sea level up to about 2,000 feet in elevation. They are common in the plains, canyon valleys, and adjacent brushy areas and open forests. This ringneck thrives as a bird of brushlands and sparse mountain-forest areas where cultivated fields are found nearby. According to Taka-Tsukasa (18) additional populations are found in mountainous districts largely devoid of croplands where they subsist primarily on wild vegetation. In the war-mined area along the 38th parallel, sizable populations of pheasants are reported to live with little or no association to agriculture.

Mountainous vegetation in inhabited areas of South Korea has been largely destroyed, resulting today in barren and denuded hills. Grass, brushlands, and scattered mixed forests may be found in more favorable locations. Usually rice and dry land crops are grown on the lowlands and lower slopes, while brush and grass dominate the lower mountainous elevations. Some forests still exist on the higher ridges.

In the central part of South Korea, oaks and alders with some conifers are common vegetation types over the countryside. Further south, warmer climate results in scattered patches of bamboo and pine, although most of the vegetation is deciduous.

The Korean lowlands make up only about one-fifth of the largely mountainous peninsula with interior rivers producing smaller valleys, all of which are intensely cultivated. In west-central Korea the capital city of Seoul is surrounded by rich agricultural land with a population density of over 640 persons per square mile. Rice, wheat, barley and other grains, soybeans, and potatoes constitute the main agricultural crops. These farmlands with nearby open brushy and wooded areas provide the most productive overall habitat for the South Korean ring-necked pheasant.

Figure 22. Prime pheasant habitat combining brush and scattered trees on the hillsides with agricultural fields at the edges.

Figure 23. Snow is common in pheasant range in the north of South Korea. Often it remains on the ground 25 to 35 days.

Figure 24. Even hills appearing barren have some forms of vegetation which South Korean ring-necked pheasants utilize.

Figure 25. Excellent pheasant habitat east of Seoul.

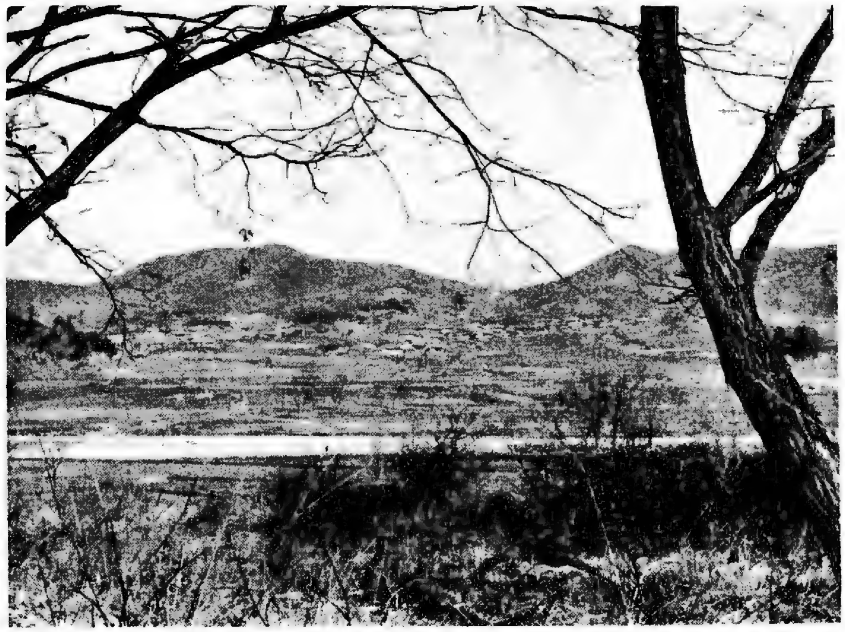


Figure 26. Low hills with agricultural valleys are ideal habitat for the South Korean ring-necked pheasant.

Figure 27. Pheasants often live in close proximity to Korean villages.

Figure 28. Typical ringneck habitat southeast of Seoul.

Figure 29. Low vegetation on ridges is composed of pine, oak, chestnut, azalea, alder and black locust with rice fields in intervening valleys.

Figure 30. Northeast coastal habitat of the South Korean ring-necked pheasant near Kangnung. Rice paddies and ridges of oak and pine are favorite locations of this pheasant.

Figure 31. Hunting pheasants in Korea has its rewards.

A second prime area for this pheasant is along the east-central coast between the Taebaek mountain range and the Sea of Japan. This area is very narrow in width and about 200 miles in length. Hills are from 300 to 2,000 feet in elevation. Pine trees and oaks are common on the hillsides. Mild winters occur here and, because only a small amount of land is available for cultivation, the human population is sparse.

The most southern habitat of the South Korean ring-necked pheasant is on Cheju Do, the largest Korean island, some sixty miles off the southwestern coast. This island, of volcanic origin, is 718 square miles in extent and has an extremely mild climate. Due to poor soil conditions the land is bare or grass covered with a limited amount of agricultural land. Only hardy cereals, such as millet, barley, and buckwheat, are grown on the lower mountain slopes together with soybeans and sweet potatoes.

The soils of Korea are generally not too fertile; only in the eroded alluvial deposits of the lowlands can be found productive agricultural lands. Volcanic activity has stopped and earthquakes seldom occur. More than half of the Korean peninsula land area is composed of soils evolving from gneisses and granites. These deposits are not true soils, as noted by McCune (11), but are immature soils greatly changed by man's activities through the centuries.

A somewhat more detailed description of the vegetation characterizing the principal pheasant habitats mentioned above, is informative. In portions of northern and west-central South Korea, adjacent to croplands, one often finds grassy hillsides with brush and low stands of oaks, pines and alders. Located below 3,000 feet in elevation, oaks (Quercus spp.) are the predominant tree species while black pine (Pinus thunbergii) is plentiful. Other tree species include bamboos (Euonymus alatus), spindle tree (Euonymus japonicus), Fagara schinifolia, Aphananthe aspera, walnut (Platycarya strobclacea), and Prunus serrulata var. spondanea.

Transplanted forest species, also present and utilized for cover and/or food by this ringneck, include red pine (Pinus densiflora), Korean white pine (Pinus korarensis), chestnut (Castanea crenata), larch (Larix spp.), oak (Quercus acutissima), Zelkova (Zelkova serrata), lacquer tree (Rhus verniciflua), acacia (Robinia pseudacacia), and alder (Alnus japonica).

In the warmer portions of South Korea, south of about latitude 35°N. and at lower elevations, are located scattered patches of pine, bamboo and other deciduous species. Cheju Do Island is included in this vegetation picture. On this island predominant tree species are: black pine, red pine, Cephalotexus koreana, evergreen oak (Cyclobalanopsis myrsinaefolia), elm (Ulmus davidiana var. japonica), Aphananthe aspera, Ligustrum japonicum; camellia (Camellia japonica var. spintanea), Quercus major, and Machilus thunbergii.

The South Korean ring-necked pheasant is common throughout the Tsushima islands, except in dense forests. Areas of cultivation, surrounded by rough country and containing grasslands, brush and scattered trees, are favorite locations for this bird. Buckwheat fields surrounded by camellia bushes (Camellia japonica) are reported by Taka-Tsukasa (18) as being so heavily frequented by pheasants that crop damage complaints may arise where the number of birds is not held down. Pine and oak trees, and bamboo are scattered over the islands while understory plants may consist of Artemesia spp., Carex sp., Vitex sp., Rubus sp., and Lespedeza spp. Grass species include Chinese silver-grass (Miscanthus sinensis) and species of the genera Agropyron, Avena, Bromus, Digitaria, Poa and Setaria, most of which are also represented in the United States.

The Manchurian ring-necked pheasant (P. c. pallasi) is reported to live under similar habitat conditions but where it is colder, the snowfall is greater and mountains are higher and more rugged, than in South Korea. Productive habitat is said to occur where hills, from 500 to 2,000 feet in elevation, are lined with oak and birch, and valleys and hillsides are planted mainly to hardy millets and oats.

Climatic Comparisons

South Korea, in general, has a humid, mid-latitude, monsoonal climate where average winter monthly temperatures are below freezing and the summers are hot and humid. The average annual precipitation varies from 23 inches in the northern interior to more than 60 inches on the southern coast and Cheju Do island. Snow falls annually on an average of 25 to 30 days along the east and west coasts of South Korea but only on an average of 18 days at Pusan on the southeast coast. Snow may remain on the ground an average of 29 and 39 days each winter at Seoul and Kangnung respectively. Snowfall is rare on Cheju Do and Tsushima islands.

Chief features of the Korean summer climate are frequent heavy rains and fairly high temperatures. The average July rainfall at Pusan in southeastern Korea is 11 inches. No area in the United States receives as much warm rain in summer as southern, and particularly southeastern Korea.

High summer temperatures occur in South Korea. At Taegu temperatures over 77°F. were recorded on an average of 116 days per summer and over 86°F. on 48 days. The highest temperature at Taegu is noted as 108°F. At Kyongsong (near Seoul) in the northwest and Kangnung to the northeast along the coast, high temperatures of 100°F. have been recorded over a 10-year period.

Winter weather is variable in Korea but freezing temperatures can be expected even at the warmest city, Pusan, for at least 35 days each year and may continue for as many as 80 days. At Seoul, freezing temperatures for 120 days or more a year are common. In cold years the

temperatures do not go above freezing for as many as 9 or 10 days as far south as Pusan and Mokpo. Figures 32 and 33 are maps of Korea illustrating the mean monthly temperatures for January and August. Lowest winter temperatures recorded on the east coast are 0°F. for Kangnung, Taegu 1°F., Pusan 10°F. and, on the west coast, Mokpo 9°F., Inchon -4°F. and Seoul -13°F. All of these weather stations are in the range of the South Korean ring-necked pheasant.

Weather on Cheju Do island, 60 miles off the southwestern coast of South Korea, is extremely mild and is classified as semi-tropical. The winters are the warmest of any region of South Korea with average January temperatures varying between 40°F. to 45°F. Hot summer temperatures prevail, with the August temperature at Cheju Do on the island's north coast averaging 78°F. Hot humid climate is normal during the summer months with most of the average yearly rainfall of 55 inches falling during this period.

On the Tsushima islands the South Korean ring-necked pheasant thrives under a June to August average mean temperature of 74.5°F. while a December to February average temperature of 41°F. is normal. Average annual rainfall is approximately 87 inches, with a high percentage falling from April through September.

A comparison of climate and topography in South Korea with some areas in the United States is given in Figure 34. This is a map of Korea superimposed on a portion of the eastern United States which graphically illustrates climatic-topographic analogues. The South Korean ring-necked pheasant would appear to find suitable climatic and habitat needs in portions of several eastern or mid-western States.

For example, temperature and precipitation, throughout most of the year along the east coast of South Korea are fairly similar to those in eastern Maryland, Delaware and southeastern Pennsylvania. A similar relationship is observable between the hilly to mountainous parts of South Korea and the uplands along the Alleghany Mountains. Climate along the west coast of South Korea appears to be rather similar to that of southeastern Iowa east to southern Illinois and Indiana. In Table 3 is presented a comparison of mean monthly temperatures in six cities, located in excellent pheasant range in South Korea, with six American cities situated in one or another of the areas mentioned above.

It should be noted that the largest difference between the climate of South Korea and that of the United States, in areas in which they are most comparable, is in the amount of rainfall and snowfall and their distribution through the year. Annual precipitation for Korea is shown in Figure 35 while snowfall is noted in Table 4.

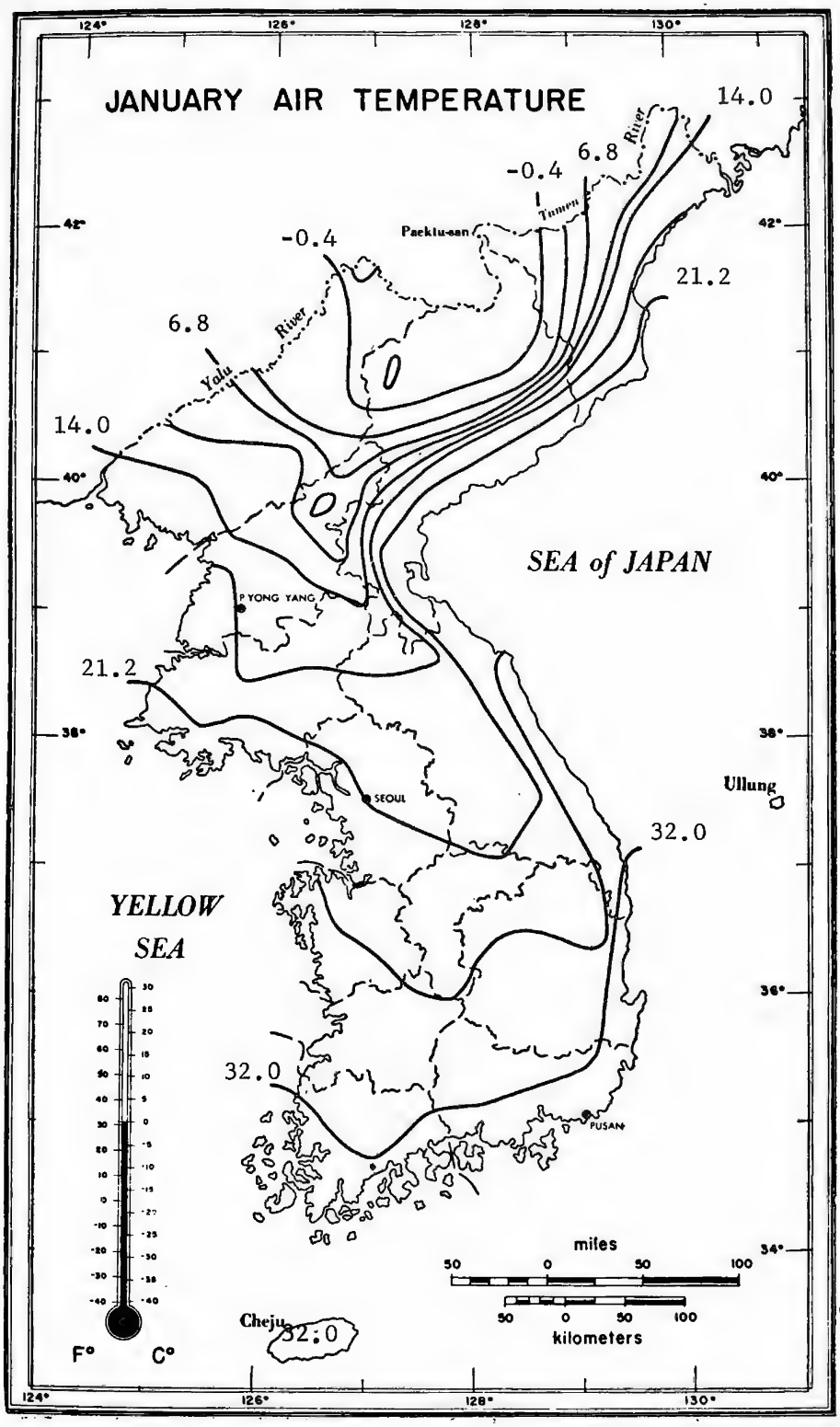


Figure 32. Average mean temperatures in degrees Fahrenheit for the month of January in Korea. (Map modified from McCune 11).

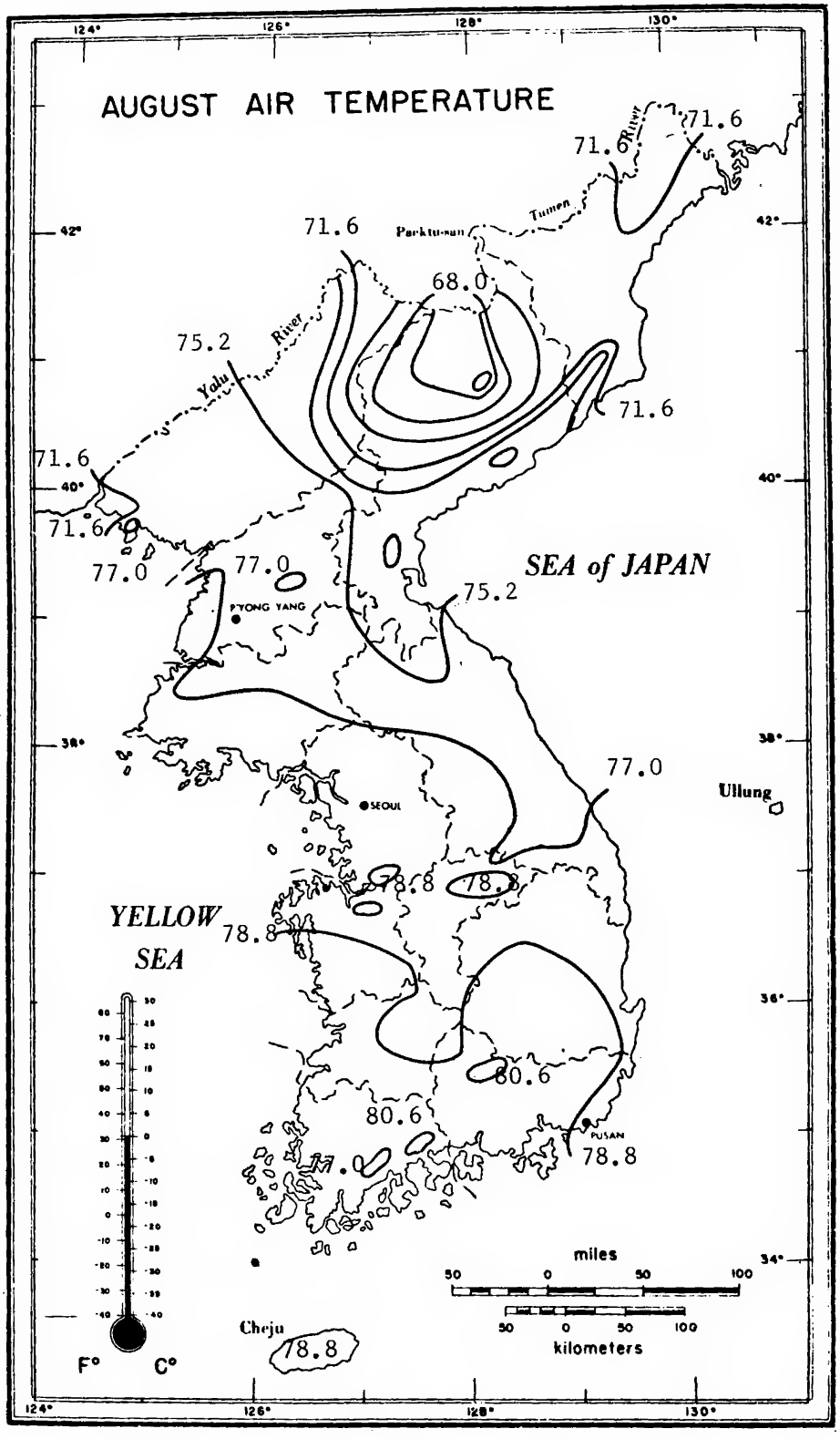


Figure 33. Average mean temperatures in degrees Fahrenheit for the month of August in Korea. (Map modified from McCune 11)

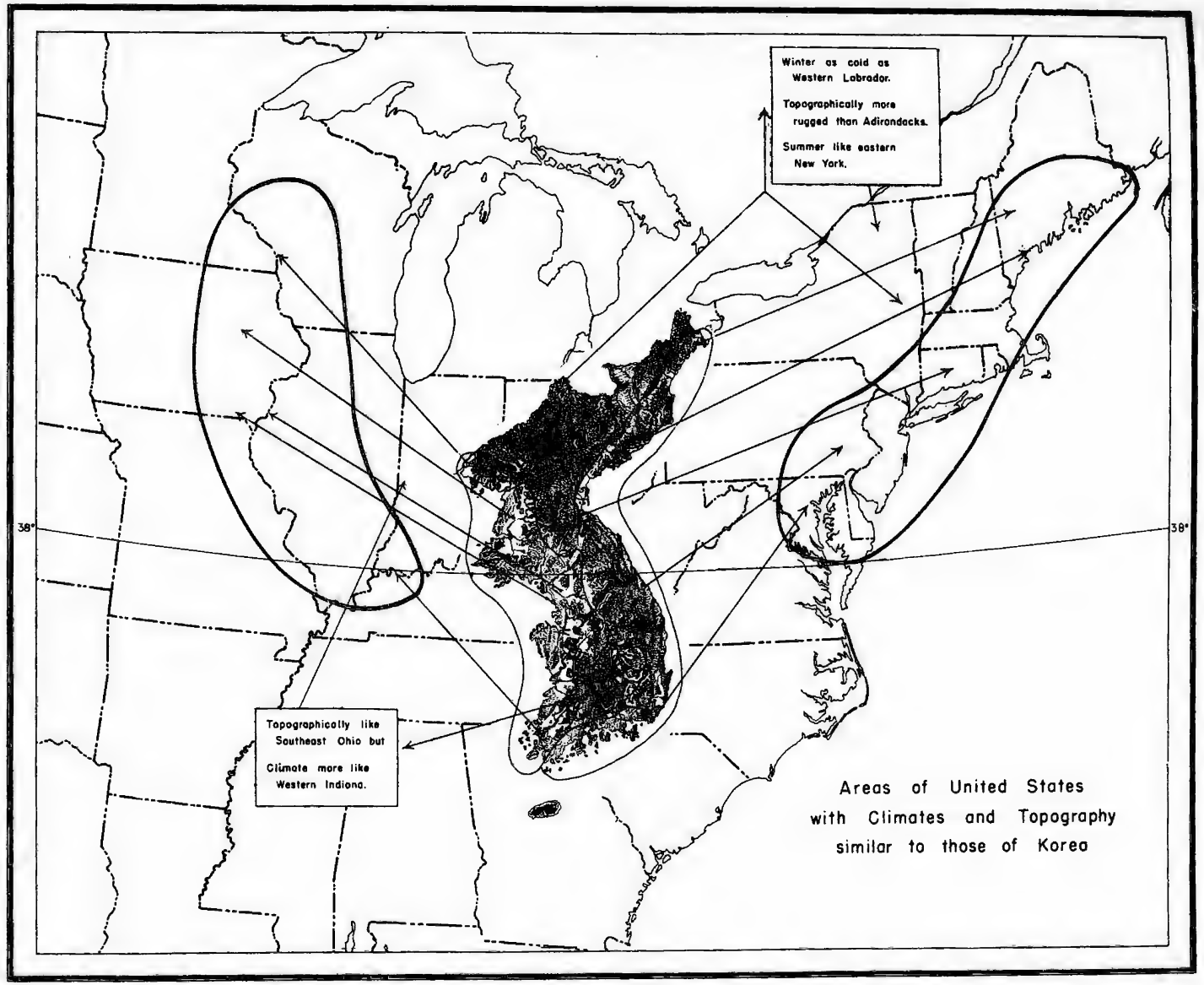

Winter as cold as Western Labrador.
Topographically more rugged than Adirondacks.
Summer like eastern New York.
Topographically like Southeast Ohio but
Climate more like Western Indiana.
Areas of United States with Climates and Topography similar to those of Korea
38°
38°

Figure 34. Comparison of climate and topography in Korea with parts of the United States. (Map from Korean Environment 14).

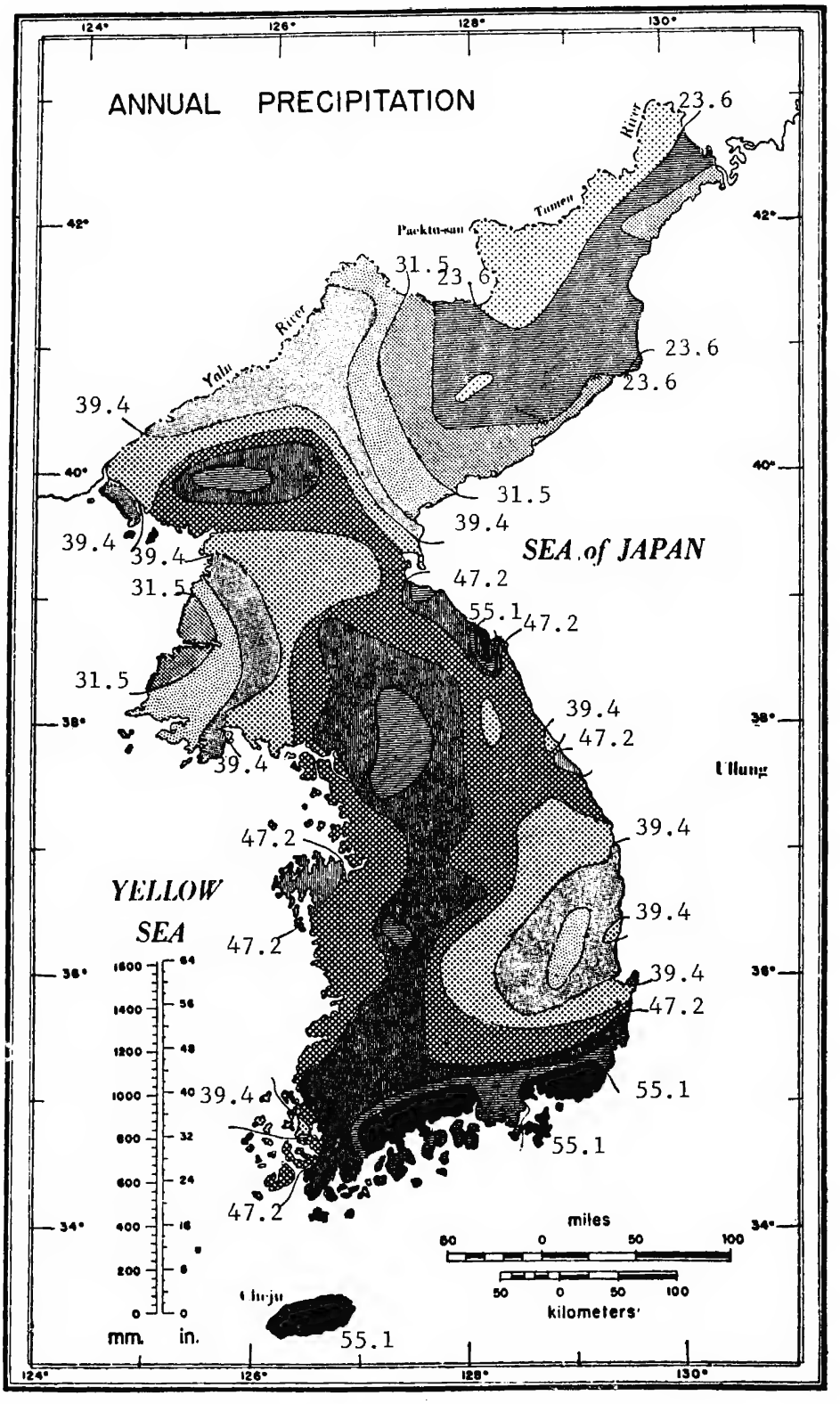


Figure 35. Annual precipitation in inches in the range of the South Korean ring-necked pheasant. (Map modified from McCune 11).

Table 3. Some climatic comparisons for cities within the range of the South Korean ring-necked pheasant with cities in the eastern United States.

Station	Elevation (feet)	Months												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yearly
Seoul	97	24	29	38	51	61	71	77	78	68	56	41	28	52
Burlington, Ia.		25	27	40	52	63	72	77	75	67	55	41	28	52
Kangnung	31	30	32	40	52	61	69	76	76	68	58	47	35	54
Reading, Pa.		31	31	41	51	62	70	75	73	67	56	44	34	53
Inchon	226	25	28	37	49	59	67	74	77	68	57	43	30	51
Peoria, Ill.		24	28	39	51	62	71	76	63	65	53	39	28	51
Mokpo	89	34	36	42	53	62	70	77	79	72	62	50	39	57
Evansville, Ind.		34	35	46	56	66	75	79	78	72	60	47	36	57
Taegu	166	30	33	42	54	63	72	79	80	70	58	46	33	55
Terre Haute, Ind.		30	31	42	54	64	74	78	76	69	57	44	33	55
Pusan	44	36	37	45	54	62	68	76	78	71	61	50	39	56
Baltimore, Md.		35	36	43	54	64	73	78	76	69	57	47	37	56

Table 4. Average number of days with snowfall in the range of the South Korean ring-necked pheasant

South Korea	No.days falling	No.days on ground
Seoul (northwest - interior)	33	29
Kangnung (northeast coast)	26	39
Inchon (west central coast)	30	21
Mokpo (southwest)	35	16
Taegu (southeast - interior)	17	8
Pusan (southeast)	18	2
Cheju Do and Tsushima Islands	rare	

Food and Water

Like the ringneck of the United States, the South Korean ringneck is an omnivorous feeder, taking a wide variety of plant and insect material. Insects are taken heavily in summer and fall. According to Taka-Tsukasa (18) fruits, grass seeds, young shoots, chestnuts, acorns, grains from croplands, soybeans, and red beans are eaten. Insect matter varies from grasshoppers to ants, while also reported taken are field mice, small reptiles, snails and earthworms. Like all ringnecks this pheasant may scratch vigorously in its search for food.

Where pheasants live near agricultural fields they feed on gleanings from crops, as well as on weeds and insects. Austin (3) reports that even after the Koreans have swept the ground surfaces clean of all cover, the pheasants remain in good body condition with crops full of various plant materials. Dr. T. Mori, as noted by Taka-Tsukasa (18), has observed that those birds inhabiting mountainous districts away from croplands can subsist on wild vegetation and insects. The weeds and insects taken by this pheasant are reported as benefiting forest trees.

Taka-Tsukasa (18), again citing Dr. T. Mori, gives the following indication of the seasonal feeding cycle of the South Korean ringneck. During the spring it feeds in or adjacent to available agricultural fields. In summer the diet turns more to insects and other animal matter and autumn feeding centers on wild feeds and gleanings from domestic crops. Fields of rice or soybeans are favorite feeding areas. These are frequented both in the morning and early evening. In winter, large numbers of pheasant are normally seen feeding in farmland fields where they glean fallen grains such as rice, millet, barley, oats and buckwheat. Where available, grain sorghum, corn, Irish potatoes, sweet potatoes, soybeans and other legume crops may be utilized.

Specific foods taken during two seasons of the year were also indicated by Dr. Mori. In spring, he reported kidney beans (Phaseolus vulgaria); beans (Phaseolus spp.); barley (Hordeum sp.); witchgrass (Panicum spp.) and knotweed (Polygonum nodosuni), were eaten. During the winter, oak (Quercus spp.); chestnut (Castanea pubinerois); squill (Scilla japonica); onion (Allium sacculiferum); Atractylis ovata; knotweed (Polygonum polymorphum); sweatleaf (Symplocos crataegoides) and soybean (Glycine soja) were consumed.

Field collections, by C. M. Fennell[(a)] of eight South Korean ring-necked pheasants between 1948 and 1962 disclosed October-to-February foods ranging from rice and beans to unidentified small and large seeds. An adult male collected in May 1953 had eaten heads of green and ripening barley.

The crop contents of one male pheasant, collected near Seoul in October, were identified by Dr. Toyosu Wada of Kochi University as follows:

Plants	Common Name	Items eaten
Vitaceae	grape family	82 seeds
Fagaceae	oak family	1 seed
Dioscorea japonica	yam	46 corms
Smilax nipponica	greenbrier	36 seeds
Cocculus trilobus	Japanese snailseed	27 seeds
Achryanthes japonica	iresine	16 seeds
Elaeagnus umbellata	autumn elaeagnus	5 seeds

Water requirements are similar to those of the ringneck in the United States. Utilized for moisture and food during various seasons of the year are green leafy vegetation, berries, insects, dew from plant surfaces, and open water, where available. With usually adequate rainfall occurring during the chick-rearing period, young birds find ample water for their daily needs.

General Habits

Movements and Mobility

The South Korean ring-necked pheasant, like the green pheasant, is nonmigratory. Only in the northern ranges where heavy snowfall occurs is there movement, mainly to lower elevations.

During the day the male birds inhabit hills sparsely covered with small pines while females are often found in thickly grassed fields. Early in the morning both sexes come to available cultivated fields for feeding and drinking, then move back to the sunny exposed hillsides.

(a) Field notes of C. M. Fennell in reference to eight skins deposited with MVZ, University of California.

After an interval in which they rest and dust, from late afternoon until about sundown, feeding again takes place, following which the evening roost is sought.

The South Korean ringneck is normally a wary bird, sneaking to cover or "freezing" in its position to avoid humans, dogs, or other danger. If approached closely it will burst from cover with loud cackling, as does our ringneck in the States. It has been observed that if driven by hawks or dogs into a tight corner it may thrust half of its body into a bush leaving the other half exposed to view.

Flight

Like all ringnecks this pheasant is capable of strong flight for short distances. The flight itself is a succession of rapid wing-beats followed by intervals of gliding. In evading hunters it glides only when at a fairly safe distance from the pursuer.

If flushed from hillsides and ridge crests it often launches itself upward then down to cross the valley, landing on the far hillside. Its flight path is usually straight, with few turns except when the bird is caught in broken terrain. A long, level flight, as for the ringneck in the States, is normally under one-quarter mile in distance. Although fairly easy to hit, its manner of springing into the air with a loud clatter of wings and a cackling call will often put even an alert hunter off-balance for a few seconds.

Wariness

Where hunted heavily, South Korean ringnecks become extremely wary. Eyesight appears to be its best sense for observing approaching danger.

Where not unduly disturbed, they can be seen feeding openly in the fields, seeking escape only when too closely approached. Use of a rifle in taking birds beyond shotgun range has been noted as fairly successful in Korea.

Resting and Roosting

They usually rest on the hillsides, with sunny exposures sought out in cold winter months. During the heat of summer they seek cover under low brush or short trees such as pines and oaks. Roosting has been reported in trees as well as on the ground. Tree roosting is apparently more characteristic of this particular pheasant than of the ringneck in the United States.

Nesting and Renesting

South Korean pheasant nests are similar in location and construction to other true pheasants, including the green pheasants of Japan. Nests are often placed in the shelter of a low bush or grass clump.

Thickets of horse chestnut or of oak brush are favorite nesting sites. Nests may be located either on hillsides or in weedy fields, and have been reported in secluded gardens in large cities. Each year nests of this pheasant have been reported on the grounds of the United States 8th Army in Seoul where rolling country, characterized by weeds, brush and trees, provides good nesting cover.

The roughly formed nest is hollowed out by the female who lines the depression with dead leaves or a few blades of grass. A clutch of eggs varies from 8 to 15 which is similar to clutch sizes of the ringneck in the United States.

Breeding season dates vary some with the elevation, but in South Korea, Cheju Do and the Tsushima islands the main period is from late April into June. In Japan the breeding season is reported as beginning in April. Young birds begin to appear in May with hatching continuing into June.

Renesting is common when the first clutch is destroyed before hatching.

Eggs

In size and color the eggs are similar to those of our ring-necked pheasant. They vary in color from dark to pale olive and there appears to be some size variation. From Korea, Taka-Tsukasa (18) cited egg measurements averaging 42.2 x 33.2 mm. Eggs collected from Tsushima island measured 44 x 34 mm.

The period of incubation varies from 23 to 24 days. According to Dr. T. Mori, from Taka-Tsukasa, eggs of the South Korean ringneck hatched under a domestic hen after 21 days incubation.

Brooding and Rearing

The brooding and rearing habits of the South Korean ringneck closely parallel those of the ringneck in the United States.

Gregariousness

No difference in the gregarious habits of South Korean ringnecks from those of pheasants in the United States has been noted.

Psychology and Behavior

Little is known about the South Korean ringneck's psychology but what has been learned corresponds closely to that of the ringneck in the United States. The Korean birds are seldom tame in the wild and even on game farms retain a considerable amount of this wildness. Although pugnacious during the breeding season, male birds seldom do serious damage to one another in their territorial fights. No other game birds seem to be persecuted by the male pheasants. Females are seldom pugnacious.

Calls

The calls of the South Korean ringneck are similar in character and periodicity to those of the ringneck in the United States. During the spring and summer breeding seasons male birds often crow every few minutes. In the Pusan area cocks were heard calling during the breeding period between March 28 and September 6, 1948, according to C. M. Fennell (9). Females usually are non-vocal except when with broods. Fall finds male birds generally silent except for the morning or evening cackle-like outbursts so familiar to the ringneck hunter in the United States. Males also cackle or give alarm calls when thunder, loud explosions or similar noises are heard. The rumble of earthquakes will also cause male pheasants to call.

Interbreeding

The South Korean pheasant, notes Austin and Kuroda (4), has interbred freely with the green pheasant in Japan. They believe the Japanese green to have been dominant, resulting in F_1 hybrids which they thought were seldom fertile. They concluded that this was the reason for the gradual disappearance of pheasants from liberation areas on Honshu, Shikoku and Kyushu. Introductions of the South Korean subspecies have been more successful in southern Hokkaido in the absence of any native green pheasant. It has been introduced there since 1930.

On the other hand, crosses between the South Korean pheasant and other subspecies of the true pheasant group have resulted in the production of fertile offspring in captivity. Game personnel in Tennessee and Ohio have indicated recently that preliminary studies show the F_1 hybrids between the Japanese green pheasant and the southern Korean ringneck to be fertile.(a)

Predation

Like the ringneck of the United States, the South Korean pheasant suffers some losses from avian and mammal predators. High pheasant numbers in Korea indicate that losses from predators are not sufficient to prevent the buildup of the pheasant population, possibly because of an abundance of rats, mice and rabbits in good pheasant habitat.

Won and Han (20) include the Korean golden eagle (*Aquila chrysaetos*), hawk eagle (*Spizaetus nipalensis*), two subspecies of broadwinged hawks (*Buteo* spp.) and the marsh harrier (*Circus* sp.) among the avian predators commonly found in South Korea in ringneck coverts. The *Accipiter* hawks are represented by two goshawks and two smaller members of this genus.

At least thirteen types of owls are present including *Bubo bubo* which the South Koreans call Clark's eagle-owl. The latter is similar to the great-horned owl of the United States. Crows (*Corvus* spp.), rooks (*Corvus frugilegus*), jackdaws (*Corvus monedula*) and black-billed magpies (*Pica pica*) are common to abundant in South Korea and probably cause some predation on eggs and chicks where the opportunity arises.

(a) Personal communications.

Foxes (Vulpes) are common in South Korea but numbers are said to be decreasing in the Seoul area as lesser numbers of skins are appearing in the fur stores each year. Mink (Mustela sibirical), weasels (M. nivalis) badgers (M. meles), the Ussurian raccoon dog (Nyctereutes procyonoides) and the small-eared cat (Felis bengalensis) are not uncommon in ring-necked pheasant range in South Korea. In addition, the Korean mink, the small-eared cat and the badger are also found in Cheju Do where a thriving population of ring-necked pheasants occurs.

Snakes were not commonly seen in South Korea by Program personnel nor were reports received to indicate that those present were of importance to pheasants.

Reproductive Capacity

In the wild the reproductive capacity of the South Korean ring-necked pheasant is similar to that of the ringneck in the United States, as is noted below:

Breeding age -- South Korean ring-necked pheasants breed in the first year following hatching.

Numbers of eggs -- The usual clutch contains 8 to 15 eggs.

Brood survival -- Reported as good except when cold, wet weather occurs soon after hatching which, according to Korean farmers, often results in high chick loss.

Life span -- Probably 1 to 2 years in the wild would be the average longevity. In captivity may live for 8 to 10 years.

Sex ratio -- Unknown. If like the ringneck in the United States, the sex ratio would be approximately equal among young birds.

Renesting -- Will renest if the first nest is disturbed or destroyed before hatching.

Second broods -- Reports of second broods probably are the result of attempts to renest.

Diseases and Parasites

Almost no attention has been given to the diseases and parasites of the South Korean subspecies in Korea and this bird is not at present sufficiently important in the hunting economy of Japan to have triggered such investigations. No reports of losses from epidemics of disease in the wild were received. Hunters in South Korea reported finding ticks occasionally on the heads of wild pheasants.

South Korean pheasants, kept on State game farms in the United States have remained as generally healthy as their Stateside cousins. It is probable that Korean pheasants are subject to the same diseases and parasites as are ringnecks in the United States and that their degree of resistance to these is comparable.

Analysis of Competing Interests

Relation to Agriculture

Pheasant damage to agricultural crops in South Korea is about what might be expected from our ringneck in the United States. When the South Korean ring-necked pheasant population numbers are overly numerous crop damage complaints are often filed by the farmer. Where hunting is employed, large populations are soon reduced and agricultural damage complaints disappear. A sizable amount of agricultural damage is exaggerated; the pheasant often is gleaning grain from the ground surface. This grain spilled on the ground would normally be lost to the farmer following the harvest. Legitimate damage complaints include the eating of green and ripening grain heads, digging for sweet potatoes, and taking soybeans and other legumes. Usually simple hazing of the birds from the fields plus hunting reduce these more seasonal crop losses.

Usefulness

As a source of food -- The South Koreans consider the ring-necked pheasant a real delicacy. South and East Gate markets in Seoul often have hundreds of wild-trapped but killed pheasants during December and January each year selling for as high as $1.80 each. A little bargaining can usually reduce this price, according to C. M. Fennell (9).

As a game bird -- A new and challenging adventure awaits the hunter when he pursues the South Korean ringneck in its preferred habitat. Rough country of ridges covered with brush or small trees allows ample cover for this wary ringneck which prefers to hide and uses flight as a last resort. Added to the difficulty of shooting over rough terrain is a disappearing target of a bird plummeting down a hillside. Its sudden eruption from sparse cover, accompanied by a loud cackle, is enough to disturb many a pheasant hunter. This ringneck is considered by many who have hunted it to be one of the more exciting and challenging game birds to shoot.

The most popular game bird in South Korea, it thrived and perpetuated its breed often under severe habitat conditions. It is certainly as enjoyable and challenging to hunt as our ringneck in the United States. According to Delacour (8) the South Korean subspecies is slightly larger than our ringnecks. No figures are readily available on pheasant numbers harvested in South Korea. The yearly take could be sizable, however, to judge by the hunting interest shown by Armed Forces personnel stationed in South Korea.

Hunting pressure in South Korea is not heavy except in the vicinity of large cities. Here pheasants often have been reduced to the extent that hunters must go farther afield for this quarry. Good bird dogs are rarely available but are highly desirable when pursuing the wary ringneck. Like many of the other true pheasants, the South Korean pheasant, in its native habitat, can withstand heavy hunting as well as netting pressure. C. M. Fennell (9) was told by a Korean friend that the natives poisoned pheasants by inserting cyanide in whole grains of corn and scattering them in the fields. It was further indicated that although the mass slaughter must have reaped a heavy toll, the species seemed to be making a strong stand.

Competition with Other Game Species

Observations indicate that the South Korean ringneck, like other subspecies of ringnecks, seldom seems to interfere seriously with other game birds whose range they share. In South Korean ringneck habitats are found scattered populations of migratory or Japanese quail (Coturnix coturnix ssp.). Fennell observed three Coturnix southwest of Pusan on April 4, 1948, but had not previously found this species for sale in the South Gate Market of Seoul, which tends to illustrate their scarcity in this northern area. Program biologists observed, in December 1958, a few of these birds on low grassy ridges east of Seoul. In this area, several hours by jeep from the city, pheasant populations were still present although hunters and trappers were responsible for a rapid reduction in their numbers.

In captivity all subspecies of the ring-necked pheasant group normally may be penned with other game birds with but little difficulty.

Breeding and Raising

Game farm personnel find the South Korean ring-necked pheasant easy to raise in captivity (7). Generally there is little difference in game farm propagation techniques concerning breeding, incubation of eggs, feeding, and raising of young as compared to those commonly in use with ringnecks in the United States.

Acceptable techniques for game farm rearing involve placing one male and four to five females together in one pen for breeding purposes. Larger holding pens are used later in the rearing season for all breeders and young birds, allowing ample pen-run space and cover.

As with other game birds, South Korean ringnecks, when wild-trapped, breed better in their second and third years on the game farm. Egg production averages between 25 to 35 a season for productive females. The period of incubation is 23 to 24 days and the percent of fertility of the eggs normally ranges from 75 to 90 percent.

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